

pp. 247-326 of the -

# PROCEEDINGS

OF THE

AMERICAN SOCIETY

OF

# CIVIL ENGINEERS.

(INCORPORATED 1852.)

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VOL. I.

NOVEMBER, 1873, TO DECEMBER, 1875.

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# AMERICAN SOCIETY OF CIVIL ENGINEERS.

## PROCEEDINGS.

AT THE ANNUAL MEETING, NOVEMBER 5TH, 1873.\*

The Annual Meeting was called to order at 10 o'clock A. M. Mr. Horatio Allen, President, in the Chair. The following were present during the session: Messrs. Samuel C. Ellis, of Boston, and Emory C. Davis, of Holyoke, Mass.; Theodore G. Ellis, of Hartford, Conn.; Charles H. Fisher, of Albany; Julius W. Adams, James H. Armington, Wilson Crosby, John Y. Culyer, John B. Dunklee, D. S. Hines, James How, Thomas P. Kinsley, Charles C. Martin, and Samuel R. Probasco, of Brooklyn; George F. Hall, of Charlton; Warren E. Hill, Thomas F. Rowland, and Lucius A. Smith, of Greenpoint; George S. Greene, Jr., of Mott Haven; William H. Searles, of Newburgh; James C. Aldrich, Theodore Allen, John Avery, Arthur Beckwith, Leonard F. Beckwith, John Bogart, Alfred P. Boller, Henry L. Brevooort, Richard H. Buel, Octave Chanute, Jacob M. Clark, Isaac D. Colman, Francis Collingwood, Robert L. Cooke, J. James R. Croes, Arthur L. Ford, George S. Greene, G. Leverich, Charles Macdonald, William W. Maclay, C. S. Maurice, James O. Morse, Edward P. North, W. Milnor Roberts, Edgar B. Van Winkle, William E. Worthen, and Edmund Yardley, of New York; and W. W. Wilson, of Yonkers, N. Y.; Robert H. Thurston, and De Volson Wood, of Hoboken; Richard D. Dodge, Andrew J. Post, and Charles D. Ward, of Jersey City; James Owen, of Newark; and Clark Fisher, of Trenton, N. J.; Thomas C. Clarke, and S. T. Fuller, of Philadelphia; Gorham P. Low, Jr., William Metcalf, and William P. Shinn, of Pittsburg, and Martin Coryell, of Wilkesbarre, Pa.; Mendes Cohen, and Charles H. Latrobe, of Baltimore, Md.; Charles Hermany, and I. M. St. John, of Louisville, Ky.

The Annual Report of the Board of Direction "on the affairs of the Society, embracing the Report of the Treasurer," was read and accepted.

A Report, prepared in compliance with the resolution of the Society, passed September 17th last, by the committee appointed at the Annual Convention "to enquire into the various modes of publishing the Papers of the Society," and a communication relating to the matter referred to the committee, from members resident in Louisville, were read and accepted.

A discussion followed; the recommendations of the committee were considered section by section, amended and adopted.

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\* An abstract of such as may be of general interest to members.

The chairman of the committee appointed at the last Annual Convention to determine the time and place of the next Annual Convention, presented the report of the committee, which was read and accepted.

A recess for one-half hour was taken.

The meeting was called to order at 2 o'clock p. m.

It was moved that the officers of the Society continue to serve until the close of the Annual Meeting.

The Society proceeded to elect officers for the ensuing year. At the first ballot Mr. Horatio Allen was unanimously re-elected President; he, for personal reasons, declined to serve. Other ballots were taken, and the following elected:

Col. JULIUS W. ADAMS, President.

Col. W. MILNOR ROBERTS and } Vice-Presidents.  
Gen. THEODORE G. ELLIS, }

Mr. GABRIEL LEVERICH, Secretary.

Mr. JAMES O. MORSE, Treasurer.

MESSRS. JOHN BOGART, CHARLES MACDONALD, and }  
FRANCIS COLLINGWOOD, Prof. DE VOLSON } Directors.  
WOOD and Mr. OCTAVE CHANUTE, }

Amendments to the Constitution of the Society, proposed at the regular meeting held October 15th last, were taken up in order, article by article, and the following only were adopted:

ARTICLE IV.—Civil, Military, Geological, Mining and Mechanical Engineers, Architects, and other persons who, by profession, are interested in the advancement of science, shall be eligible for admission in their appropriate class.

ARTICLE XVI.—The active members of this Society shall be divided into three classes, to be styled respectively, Members, Associates, and Juniors; and each person, when duly elected and qualified, shall receive a certificate of membership, indicative of the peculiar class which he represents. Associates and Juniors shall possess all the rights and privileges of Members, excepting the right of voting.

ARTICLE XVII.—To be eligible as an Associate, the candidate must be one whose connection with science or the arts qualifies him to concur with civil-engineers in the advancement of professional knowledge. To be eligible as a Junior, the candidate must have been in the actual practice of his profession for at least two years.

ARTICLE XIX.—All candidates for admission to the Society must file statements by themselves, setting forth the grounds of their claim to be elected; be proposed by at least two Members of the Society, to whom they must be personally known, and a notification of the same sent to each member whose place of address is on record. Each proposition, with the names of the proposers, must be posted in some conspicuous place in the rooms of the Society, for at least thirty days before being submitted to vote. All such papers and applications shall be laid before

the Board of Direction, and be reported upon, previous to action by the Society.

ARTICLE XX.—In elections for membership of either class, Members shall vote by letter, or by ballot in the usual way, and the result shall be announced at the next regular meeting held after thirty days have elapsed from the time of mailing the notification. Three or more ballots cast in the negative shall exclude. Members notified but not responding, shall be classed as having voted in the affirmative.

ARTICLE XXII.—Persons thus elected and duly qualified, who reside in the city of New York, or within fifty miles thereof, shall be deemed Resident; and those who reside beyond those limits shall be deemed Non-resident.

ARTICLE XXIII.—The amount of entrance-fee to be paid, as well as the annual dues or assessments for the support of the Society, shall be determined from time to time, at some regular meeting of the Society, provided that notice of intended action thereon shall have been given at a previous regular meeting. No alteration in the amount of said fees or assessments shall apply to the fiscal year during which it is made, but shall take effect on and after the first Wednesday in November next succeeding the day of the date of said alteration.

ARTICLE XXIX.—Resident Members, Associates or Juniors, who may remove beyond the limits prescribed in Article XXII, for the term of one year or more, shall be subject to the payment of such fees and assessments only as are prescribed for Non-residents, provided that the person thus removing shall give the Secretary of this Society written notice of such removal. This privilege, however, shall not apply to any fractional part of the fiscal year.

ARTICLE XXX.—Every person admitted to the Society shall be considered as belonging thereto and liable to the payment of all assessments, until he shall have signified to the Secretary his desire to withdraw; when, if his dues have been fully paid up, his name shall be erased from the list of members.

ARTICLE XXXI.—Any person admitted to the Society, who shall refuse to pay any assessment or other dues to the Society, or who shall neglect the same for the term of six months, after due notice is issued in the Form C, in the Appendix, shall cease to be a member.

ARTICLE XXXV.—Proposed amendments to this Constitution shall be first submitted to the Society, and seconded, and then sent by letter to the several Members of the Society, at least twenty-eight days previous to the Annual Meeting. Such amendments shall be in order for discussion at such Annual Meeting, and shall be voted upon by letter-ballot, within sixty days after the date of said meeting. The votes shall be counted by the President and Secretary, and if two-thirds of the votes are in favor of said amendment, it shall be declared adopted, and the result announced at the next regular meeting of the Society thereafter.

Mr. James O. Morse proposed the following amendment to the By-Laws of the Society:

SECTION . . . . .—Persons who shall be elected members of this Society after six months of any fiscal year shall have expired, shall pay only one-half the amount of dues for that fiscal year, otherwise required—which was seconded, and, under the rule, referred for action to a future regular meeting of the Society.

The following were adopted:

Resolved,—that hereafter the fiscal year for the Treasurer's Report shall end on the first day of October, and the Treasurer's Report shall be made to the Board of Direction, printed, and sent to each Member by the first day of November.

Resolved,—that the meetings of the Society, on the third Wednesday in each month, be held at 8 o'clock P. M., *solely* "for professional improvement" and "the encouragement of social intercourse among men of practical science;" and that for such meetings the order of business prescribed by the By-Laws is hereby permanently set aside.

Resolved,—that a committee of five be appointed to revise the By-Laws of the Society, and make them correspond with the Constitution, as amended.

The President named Mr. G. Leverich, Col. Julius W. Adams, Gen. George S. Greene, Mr. Octave Chanute, and Mr. Charles Macdonald, as such committee.

It was determined to hold the next Annual Convention of the Society in New York, June 10th and 11th, 1874, and the Society then adjourned.

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#### PROCEEDINGS OF THE BOARD OF DIRECTION.\*

NOVEMBER 11TH, 1873.

A meeting was held at 2 o'clock P. M., for the appointment of Standing Committees and the transaction of regular business.

The President appointed committees for the ensuing year, as follows: on Finance, Mr. John Bogart, Col. W. Milnor Roberts, and Gen. Theodore G. Ellis; on Library, Mr. Charles Macdonald, Prof. De Volson Wood, and Mr. Francis Collingwood.

It was Resolved,—that the committee appointed by the last Board of Direction, at its meeting October 15th, 1873, "to prepare a draft of an amended Constitution, to be presented to the Board at some future day," etc., etc., be continued as a committee of this Board, and that vacancies existing in said committee be now filled by ballot.

A ballot was taken, and Col. W. Milnor Roberts elected; the committee consists of Col. Julius W. Adams, Col. W. Milnor Roberts, and Mr. John Bogart.

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\* An abstract of such as may be of general interest to members.

The Treasurer was made a committee, appointed under a resolution of the Board, passed January 29th last, to procure a seal, book-mark and diploma of the Society.

The Secretary was instructed not to announce regular meetings of the Society from July 15th to August 19th next, inclusive; proposals for admission to the Society were considered, and the Board adjourned to meet on Tuesday, November 25th next, at 2 o'clock p. m.

## REPORTS.

### THE ANNUAL REPORT OF THE BOARD OF DIRECTION.

Presented and accepted November 5th, 1873.

The Board of Direction, in compliance with Article XII of the Constitution, herewith present "a Report on the affairs of the Society, embracing the Report of the Treasurer" for the year ending this day.

On November 5th last, the membership was—

Honorary members, non-resident .....	4
Members, resident, 103 ; non-resident, 175 ; total .....	278
Associates " 2 " 5 " .....	7
	<hr/> 285

Fellows, 61, of whom 12 were Members, and 1 Honorary Member, leaving.....	48
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Total connected with the Society..... 337

To day the membership is—

Honorary Members, resident, 1 ; non-resident, 5 ; total...	6
Members " 108 " 221 " ...	329
Associates " 6 " 11 " ...	17
	<hr/> 346

Fellows, 77, of whom 13 are Members, 1 Honorary Member, and 1 is deceased, leaving .....	62
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Total connected with the Society..... 414

During the year two Honorary Members were elected, and the nominations of four are pending.

On November 5th last, the number of applicants for admission

to the Society, not acted on, was..... 17

There were proposed during the year..... 81

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98

Of this number, 63 were elected as Members, 11 as Associates, and 19 are before the Society ; of those elected before November 6th last—there qualified during the year, 7 as Members and 1 as Associate.

Of the 63 Members elected during the year, 51 qualified, 3 declined,



and 9 have to qualify ; and of the 11 Associates, 9 qualified, 1 declined, and 1 has to qualify.

The increase during the year has been—

Honorary Members.....	2
Members qualified, 58—less 1 made Honorary Member, 3 resigned and 3 deceased—7.....	51
Associates qualified .....	10
	61
Fellows subscribed, 16—of whom 2 are Members, leaving.....	14
	77
Total increase.....	77

During the year one special and twenty regular meetings of the Society were held ; one of which was the Fifth Annual Convention at Louisville, Ky.

At the last Annual Meeting it was—"Resolved, that until ordered otherwise, the meetings of the Society on the third Wednesday of the month be held in the evening." In accordance therewith, from November to April, evening meetings were held, at which "the order of business prescribed by the By-Laws was laid aside, and gentlemen present, not members of the Society, were invited to remain and participate in the discussions"—which were confined solely to the consideration of professional subjects.

The attendance upon the meetings of the Society has been greater than during previous years, and continues to increase. That upon the evening meetings, the interest there exhibited in the papers read and subjects examined, suggest at least the propriety of henceforth holding regularly one meeting a month, in the evening, "for professional improvement and social intercourse among men of practical science."

The Annual Convention was held at Louisville, Ky., May 21st and 22d last, and attended by the largest number of civil engineers ever assembled together on this continent. Full notes of the exhaustive discussions called forth by the papers there presented were taken, and carefully revised by those who took part ; these and the other proceedings await such disposition as the Society may make of them.

The Papers read at the several meetings of the Society held during the year are as follows :

"A Record of some Experiments, showing the Character and Position of Neutral Axes as seen by Polarized Light," by Louis Nickerson, C. E. ; discussions by Hon. William J. McAlpine, Gen. John G. Barnard, Gen. Theodore G. Ellis, Col. William E. Merrill and Estevan A. Fuertes, C. E.

"Coal Cutting Machinery in England," by T. Guilford Smith, C. E. ; discussions by J. Dutton Steele, C. E., and Martin Coryell, C. E.

"Alcohol as an Illuminator of Caissons," and "Rock Drilling," by Francis Collingwood, C. E.

"Experiments on the Resistance of Stones to Crushing," by Charles B. Richards, M. E.



- "Retaining Walls," by Casimir Constable, C. E.
- "Pneumatic Foundations," by Gen. W. Sooy Smith; discussion by Charles C. Martin, C. E.
- "Manufacture of Pneumatic Piles," by Robert Cartwright, M. E.
- "Screw Piles," by Charles D. Ward, C. E.
- "Proportions of Pins used in Bridges," by Charles Bender, C. E.; discussion by Charles Macdonald, C. E., and Prof. De Volson Wood.
- "Account of the Operation of the Gunpowder Pile Driver," by Samuel R. Probasco, C. E.
- "Rail Economy—Reply to Discussion," by C. P. Sandberg, C. E.
- "Leakages in Water Pipes," by Joseph Whitney, C. E.
- "The Adaptation of Mechanical Power to the Work of Charging and Discharging Gas Retorts," by Thomas F. Rowland, M. E.
- "Tests of Bridge Irons," by J. Dutton Steele, C. E.
- "Notes on the Crushing Strength of American Iron," by Thomas C. Clarke, C. E.
- "The Detroit River Tunnel," by E. S. Chesbrough, C. E.
- "Production of Traffic, and the Transportation of Freight and Passengers," by Martin Coryell, C. E.
- "Tables of the Strength of Cast Iron Columns," by E. Thacher, C. E.
- "Backwater in Rivers as caused by Dams," by Prof. De Volson Wood.
- "Water Power of the Falls of the Ohio," by M. S. Belknap, C. E.
- "Iron Hulls for Western Steamers," by Theodore Allen, M. E.
- "Foundations under Water," by Gabriel Jordan, C. E.
- "Foundations of the New Capitol at Albany," by Hon. William J. McAlpine.
- "Causes of the Formation of Bars at the Mouths of Rivers," by Gen. Theodore G. Ellis.
- "Economy of Railroad Curvature," by Wilson Crosby, C. E.
- "Levees of the Mississippi," by Caleb G. Forshay, C. E.
- "Results of Experience and Observation in Working the Gunpowder Pile Driver," by William J. Holroyde, C. E.

Generally, Papers were announced in time to give members who wished to take part in the discussions opportunity to prepare therefor; and in some cases, manifold copies of the Paper to be presented were sent to those likely to have experimental knowledge of the subject treated.

Several of the Papers were accompanied by models. The machinery described in the Paper read by Mr. Rowland was fully illustrated by a large and complete working model in operation.

Abstracts of these Papers have regularly appeared in scientific journals here and abroad; and several of those read before the Annual Convention, and the discussions, were published by the Louisville journals and copied by other newspapers.

The publications of the Society during the year have been as follows :

"Proceedings of the Annual Meeting of the Society, held November 6th, 1872," and

"No. LIII, Transactions.—On the Composition of Ancient Cements and Rosendale Cements, read by Arthur Beckwith, C. E., June 16th, 1869," issued January 30th, 1873.

"Members of the American Society of Civil Engineers, 1873," and

"No. LIV, Transactions.—The Mexican Method of Making Hard Lime Floors, presented by Gen. Theodore G. Ellis, March 20th, 1872," issued February 20th, 1873.

"No. LV, Transactions.—Notes on the Resistance of Bricks to a Crushing Force, presented by George S. Greene, Jr., C. E., March 20th, 1872," and

"No. LVI, Transactions.—Experiments on the Resistance of Stones to Crushing, presented by C. B. Richards, M. E., January 8th, 1873," issued March 8th, 1873.

"Proportions of Pins used in Bridges, presented by Charles Bender, C. E., February 19th, 1873," issued February 25th, 1873.

"Reports of the Committees on Chapters, April, 1873," issued May 9th, 1873.

"No. LVII, Transactions.—Quay and other Retaining Walls, read by John D. Van Buren, Jr., C. E., January 17th, 1872," issued May 9th, 1873.

"Report of the Committee on Publishing the Papers of the Society, September, 1873," issued September 22d, 1873.

The Transactions issued during the year extend from page 170 to page 223, Volume II ; as they appeared they were reprinted in the leading scientific and technical periodicals in this country and abroad.

At an informal meeting of Members held January 7th, 1873, it was

"Resolved,—that the sense of the meeting is, that when any Paper is submitted to this Society, it shall be referred to the Secretary before reading, who, with advice and consent of the Library Committee, shall decide whether it shall be printed ; if yes, it shall be printed and circulated among the members, with a notice that it shall be read and discussed at a future day."

In accordance therewith, the paper by Charles Bender, C. E., "Proportion of Pins used in Bridges," was printed in 12mo form and sent to members, February 25th, 1873, with this "Note.—This paper is issued in this form that members may participate in its discussion on April 2d, next, either personally or by sending a letter to the Secretary."

At a regular meeting of the Society, held March 5th, 1873, it was

"Resolved,—that hereafter, every Paper presented to the Society shall be immediately examined by the Library Committee, which shall decide whether it shall come before the Society. If yes, it shall be printed in cheap form, and distributed to members, with notice that discussion,

written or oral, will be received within definite limits as to time ; at the expiration of which said discussion shall be referred to a Special Committee, with instructions to examine and recommend a final disposition of the same, with reference to the permanent proceedings of the Society."

The response from the members of the Society to the note attached to the paper of Mr. Bender, having failed to elicit the amount of written discussion aimed at, the Board of Direction do not advise a continuance of the method prescribed, and accordingly recommended that the preceding resolution be repealed.

At the Annual Convention, May 22d, 1873, it was

"Resolved,—that a committee of seven, consisting of the present Library Committee and four other Members, be appointed to inquire into the various modes of publishing the Papers of the Society, and to report upon the same, at as early a day as practicable ; and that the Secretary send a printed copy of their report to each member of the Society, requesting in return an expression of opinion on the subject."

Messrs. Charles Macdonald, Alfred P. Boller, Francis Collingwood and Gen. George S. Greene were appointed the additional Members of the committee.

The report of the committee was presented September 17th last, with a recommendation that it be sent to members with a circular, asking from them a general expression of opinion upon the subjects treated; the replies to be referred to the committee for report thereon at this Annual Meeting, and that final consideration of "the various modes of publishing the Papers of the Society" be made a special order for this day. The Report was accepted, and the action recommended ordered.

During the past year the library of the Society has nearly doubled, mostly by the contributions of members and others interested in its growth. In May last was received the first portion of the valuable collection of professional works presented to the Society by Hon. William J. McAlpine, consisting in great part of written and printed Reports upon public improvements, in sets, more or less complete, some being the only copies to be had at present. Cases for these additions to the library were provided, and are now nearly filled.

As the worth of such an accession of recorded information, covering a wide range of professional experience, is contingent much upon the ease with which it can be consulted, it has been determined to prepare a complete catalogue, to comprise the title, subject and author's name (when given) of every separate book or paper in the library of the Society ; and such is nearly finished.

Special acknowledgment is here made of old and rare works, donated to the library as follows :

By Martin Coryell, Esq. :—

Fifth Annual Report of the President and Directors to the Stockholders of the Baltimore R. R. Co. Baltimore, 1831. Octavo.

Reports on Canals, Railways, Roads, etc, made to Pennsylvania Society for Promotion of Internal Improvement. William Strickland. Philadelphia, 1826. Long quarto.

By Frederick H. Cruss, Esq. —

A Historical and Descriptive Account of the Suspension Bridge Constructed on the Menai Strait in North Wales: with a Brief Notice of Conway Bridge. From designs by and under the direction of Thomas Telford. By W. A. Provis, Resident Engineer. London, 1828. Folio.

By Thomas F. Rowland, Esq.:—

A Treatise on Bridge Architecture. By Thomas Pope. (Probably 1808.) Octavo.

Prof. George W. Plympton, presented to the Society a framed autograph, of which this is a copy :

“BANK OF GEORGETOWN,

“August the 12th, 1803.

Pay the bearer ten dollars,

“\$10,

ROB'T FULTON.”

There has been added to the library and museum during the year :

	Of the McAlpine Collection.	By other Donors.	Purchased.	Total.
Books bound. ....	384	229	12	625
“ unbound, and pamphlets. ....	277	440	..	717
Manuscripts, bound. ....	12	..	..	12
“ in sheets. ....	8	38	..	46
Maps and plans, bound. ....	36	..	..	36
“ “ in sheets. ....	10	9	..	19
Charts. ....	..	32	..	32
Drawings. ....	..	48	..	48
Photographs. ....	..	38	..	38
Models. ....	..	6	..	6
Specimens. ....	..	10	..	10

This does not include magazines and papers contributed to the Society, by their respective publishers, and in receipt at these rooms as follows :

“Annales des Ponts et Chaussées,”.....Quarterly, Paris.

“Engineering,”.....Weekly, London.

"Iron,"	Weekly, London.
"Journal of the Society of Arts,"	London.
"Monthly Record of Scientific Literature,"	Monthly, New York.
"Official Gazette of the U. S. Patent Office,"	Weekly, Washington.
"Railroad Gazette,"	New York.
"Scientific American,"	" "
"The American Chemist,"	Monthly, Philadelphia.
"The Builder,"	Weekly, London.
"The Building News and Engineering Journal,"	London.
"The Chicago Railway Review,"	Chicago.
"The Commissioner of Patents Journal,"	London.
"The Engineer,"	" "
"The Engineering and Mining Journal,"	New York.
"The Iron Age,"	" "
"The Journal of the Franklin Institute,"	Monthly, Philadelphia.
"The Manufacturer and Builder,"	New York.
"The Popular Science Monthly,"	" "
"Van Nostrand's Eclectic Engineering Magazine,"	" "

Including these, some of which have been received from commencement, and making altogether 45 unbound volumes, the present state of the library is as follows :

Books bound	1,275
" unbound and pamphlets	1,516
Manuscripts	81
Maps and plans, drawings and charts	344
Photographs and engravings	217
Models	12
Specimens	83

At the meeting of the Society, July 2d, 1873, the following was adopted :—Whereas, the foundation of a library and museum, which contains within itself all accessible published matter relating to the history, theory and practice of engineering, the construction and management of public improvements, and the methods and costs of manufacturing operations, with illustrations by models and samples of the results thereby obtained, must be invaluable, not only to the profession, but to all who are interested in the pursuit or the application of practical knowledge."

"Resolved,—that a committee consisting of the President and nine other Members to be named by him, with power to fill vacancies, be appointed to devise a plan whereby such a library and museum may be founded ; the funds obtained for its collection, management, increase and maintenance ; a suitable place secured where it and other possessions of the Society may be preserved, and the advantages enjoyed by members and others connected therewith, irrespective of their location."

The committee appointed consists of Mr. Horatio Allen, Col. Julius W. Adams, Messrs. E. S. Chesbrough, Alfred P. Boller, Thomas C. Clarke,

James O. Morse, Charles Hermany, Gabriel Leverich, Charles Paine and Gen. Theodore G. Ellis.

In 1872, George H. Norman, Esq., of Newport, R. I., Member and Fellow of the Society, presented a prize fund, from which a gold medal is to be awarded each year for the best essay on engineering subjects; this sum was invested and now amounts to \$1,250.

It was determined that competition for the medal should be restricted to members of the Society, and that Papers submitted therefor, be of practical engineering interest, and comprise either descriptions of structures, completed or in course of erection, or a record of experiment illustrating well defined theory. Mr. Norman has prepared a graceful and appropriate design for the medal; the die is now in the hands of the engraver, and soon announcements may be made of conditions for the first award.

On December 5th, 1872, a circular was sent to members which stated:—"The Constitution of the Society requires names of applicants for admission to membership to be posted in these rooms for thirty days before being submitted to vote. Many Members do not have an opportunity to see these names. By resolution of the Board of Direction, a list will be sent monthly to each Member, with the request that any information be communicated to the Secretary in reference to an applicant that will enable the Board to act judiciously upon his application." Announcements were subsequently made, to Members during the year, of applicants for admission.

The Society in regular meeting, held May 7th, 1873, adopted an amended form of application for admission, of which this is a copy:

"AMERICAN SOCIETY OF CIVIL ENGINEERS,

(Organized November 5th, 1872.)

63 William street, New York.

of.....being desirous of admission into  
the American Society of Civil Engineers, beg leave to submit the follow-  
ing as my professional record\*.....

(&c.)

Signed.....Applicant.

Dated....."

"On the grounds stated, and because we believe him, from personal knowledge, to be in all respects a proper person to be admitted into the American Society of Civil Engineers, we hereby recommend Mr. ....  
for election as .....

Signed †.....

} Members of the  
American Society of  
Civil Engineers."

\* The Name and Address of the Applicant should be written in full; the statement of Professional Service should embrace a concise narrative, with dates, of his professional career, specify the positions he has held, the nature and extent of the works in or upon which he has been engaged, and give an idea of their magnitude and importance.

† The application must be signed by at least two Members of the Society, who, from personal knowledge, vouch for the applicant.

"The Board of Direction of the American Society of Civil Engineers, having considered the foregoing application for admission to membership, hereby report that \_\_\_\_\_ is eligible under the Constitution and By-Laws for \_\_\_\_\_ and recommend that a ballot be taken.

Secretary.

Dated \_\_\_\_\_"

At the regular meeting of the Society, December 4th, 1872, a communication was received from the Board of Direction, as follows:

"At a meeting held this day—"Resolved,—the Board of Direction do hereby recommend to the Society, that after February 1st, 1873, the fee to be paid by Fellows under Article XXVI of the Constitution, be \$250." This recommendation was adopted by the Society, and no subscriptions to the Fellowship Fund at the increased rate have been received; in view of which fact, the Board would here recommend that such rate be reduced to \$100.

At the regular meeting of the Society, October 1st last, the following was communicated from the Board of Direction: "Resolved,—that this Board of Direction do not recommend to the Society any change in the amount of initiation fees and annual dues for the coming year;"—which was accepted.

The Treasurer's Annual Report is herewith submitted:—

NEW YORK, Nov. 4th, 1873.

*To the American Society of Civil Engineers:*

The undersigned begs leave to present the following Report, as Treasurer, for the year 1872-3, ending this day:

Balance on hand as by last Report.....	\$518 42
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#### RECEIPTS.

Annual dues, 1872-3, from 59 Resident Members...	\$1,390 00
Annual dues, 1872-3, from 84 Non-resident Members .....	1,535 00
Annual dues of former years from 8 Resident Members.....	255 00
Annual dues of former years from 5 Non-resident Members.....	65 00
Entrance fees from 67 new Members.....	1,740 00
Annual dues (72-3) 67 new Members.....	980 00
Over-payments from foreign Members.....	7 15
Proceeds of sale of publications of Society.....	86 50
	6,058 <sup>1</sup> / <sub>2</sub> 65
	\$6,577 07

#### EXPENDITURES.

Total by 90 vouchers presented per abstract VII:

Salary.....	\$3,000 00
Janitor.....	96 00



Rent and fire.....	\$870 00	
Postage.....	198 33	
Stationery and circulars.....	418 21	
Report of Convention.....	87 50	
Engraving.....	67 00	
Printing Transactions and Reports.....	573 23	
Furniture (book-cases).....	459 26	
Library.....	173 24	
Gas.....	11 66	
Insurance.....	29 00	
Miscellaneous.....	19 54	
		<hr/>
		\$6,002 97
Cash balance.....		<hr/>
		\$574 10

## STATEMENT.

Cash balance brought over.....	\$574 10	
Stocks.....	536 25	
Deposits.....	675 89	
		<hr/>
		\$1,786 24
Value of library, furniture, etc (estimated).....		3,350 00
Unpaid dues of former years.....		2,330 00
Annual assessments due this day, paid.....	\$985 00	
“ “ “ “ unpaid.....	5,190 00	6,175 00
		<hr/>
Total.....		\$13,641 24
Fellowship fund.....	\$8,500 00	
Norman Medal.....	1,250 00	
Insured value McAlpine library.....	2,000 00	
		<hr/>
		11,750 00
		<hr/>
		\$25,391 24

Respectfully submitted,

JAMES O. MORSE,

Treasurer.

During the year the Society has mourned the loss of—

GEORGE M. DEXTER, C. E., of Boston, Mass.; admitted to the Society December 3d, 1852, the eighteenth on the record, who died November 26th, 1872.

SAMUEL STEWART CHASE, C. E., of Holyoke, Mass.; admitted to the Society, December 8th, 1868, who died May 29th, 1873.

Gen. WILLIAM H. SIDELL, of New York; admitted to the Society, December 1st, 1852, the seventh on the record, who died July 1st, 1873; and

SAMUEL B. CUSHING, C. E., of Providence, R. I.; admitted to the Society, September 24th, 1869, who died July 17th, 1873.

Memoirs of the deceased are appended.

Respectfully submitted,

G. LEVERICH,

Secretary.

November 5th, 1873.



## FINAL REPORT

OF THE COMMITTEE ON PUBLISHING THE PAPERS OF THE SOCIETY,

As amended and adopted November 5th, 1873.

*To the American Society of Civil Engineers :*

At the regular meeting of the Society, held September 17th last, the committee appointed at the Annual Convention "to inquire into the various modes of publishing the Papers of the Society" presented a Report, which was read and accepted.

On motion, it was ordered that the Report be printed and sent to members with a circular, asking them to express, in terms as set forth therein, opinion on the subjects treated; that their communications be referred to the committee for report at the Annual Meeting of the Society, and that final consideration of the "modes of publishing the Papers of the Society" be made a special order for that day.

In compliance therewith, the following Report is submitted :

In response to the circular sent out, 66 replies were received, some at considerable length; these were examined by the committee, and are here presented in a condensed form.

To the first question of the circular: "What Papers, if any, shall be rejected by the Society, and what shall be the standard of selection for publication from those accepted?" most reply, substantially—"Papers containing old matter readily found elsewhere, those specially meant to advocate personal interests, those carelessly prepared or controverting established facts, and those purely speculative or foreign to the purposes of the Society," should be rejected—as determined by a committee to whom the contributions are referred; some advise that this committee be selected by an officer of the Society from members possessing special knowledge of the subject treated.

To the second question: "What shall be the style and form of page of the Society's publications?" most reply—The same as that heretofore of the Society's Transactions, though some prefer that of Van Nostrand's Eclectic Engineering Magazine.

To the third question: "Shall all the Society publishes be printed together and issued at regular times?" most reply, "Yes"; some advise that the publication be monthly, and, a few, quarterly.

To the fourth question, first clause: "Shall select advertisements be attached?" most reply, "Yes;" and to the second clause: "Shall 'subscriptions' be 'taken from non-members'?" the answers, pro and con., are nearly equally divided.

The fifth question: "Shall the publication of a journal, as outlined on page 12 of the Report, be attempted?" seems to have been considered by many who responded as referring to what is covered by the third question above quoted, and not to a journal containing original and se-

lected engineering literature ; therefore the replies fail to guide the committee.

In answer to the circular, several members submitted to the committee much that pertains to the general subject which could not be summarized in the replies here given ; the committee regret that these expressions of opinion on the manner of publishing by the Society, from those who have thoughtfully considered it, cannot be included in this Report.

After a careful examination of the matter referred to them, in connection with the views of members thus presented, the committee recommend to the Society as follows :

1st. That when a Paper is presented to the Society, the Secretary shall at once examine it and report thereon to the Committee on Library, with reference to this standard : "Papers containing old matter readily found elsewhere, those specially meant to advocate personal interests, those carelessly prepared or controverting established facts, and those purely speculative or foreign to the purposes of the Society," should be rejected. The committee shall then determine whether such paper may go before the Society ; they can return it to the writer for correction and emendation, and call to their aid one or more members of special experience relating to the subject treated, either to advise on the Paper or to discuss it.

2d. That the Society issue a publication on the second Wednesday in each month, of not less than 48 octavo pages, with type and print for the Papers similar to that of the Society's Transactions, and smaller or more compact, for the less important matter, if necessary.

3d. Such publication to contain : Papers as submitted to the Society, promptly upon their acceptance ; Papers already submitted, still unpublished and the discussions thereon, beginning with the proceedings of the last Annual Convention ; comments and discussions on Papers thus published ; a current list of new scientific and engineering books, with brief examinations of the more important, at the discretion of the Committee on Library ; abstracts of proceedings of the Society and Board of Direction which are of general interest to members ; announcements of meetings to be held, Papers read and topics discussed ; Reports and other communications from the Society to members, and professional inquiries and replies from members themselves ; and a list of additions to the library and museum during the preceding month, with acknowledgments of donations received ; also, that select advertisements, to be approved by the Committee on library, be received and published therewith.

4th. The pages to be "made up" so each Paper and the discussions thereon may be consecutively arranged for binding, and the other less valuable matter detached ; the numbers copyrighted, to prevent an unauthorized reprint, or one without acknowledgment ; the Papers and discussions may be stereotyped, for issue at yearly intervals in bound volumes of such as shall then be deemed worth preserving. And

5th. That no subscriptions to this publication be received at present,

but that, after members are supplied without charge, numbers be sold to them *only*, at a price fixed by the Committee on library.

In the previous report of the committee (page 12), the cost, including tabular matter and illustrations, of publishing 1,000 copies, 50 pages octavo (as now), each month, or 600 pages per annum, was estimated at .....\$2,248 20

From this a deduction was made of the saving in expense of circulars and postage, if a regular publication is considered, of 325 00

leaving as net cost per year of publishing, as planned.....\$1,923 20  
which, with a reasonable allowance for error in estimating or increase in prices, is believed to be *quite* within the present means of the Society.

Respectfully submitted,

CHARLES MACDONALD,

Chairman of Committee.

November 5th, 1873.

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## REPORT

OF COMMITTEE ON THE TIME AND PLACE OF THE SIXTH ANNUAL CONVENTION,

Presented and accepted November 5th, 1873.

*To the American Society of Civil Engineers:*

The Committee appointed at the last Annual Convention to determine the time and place of the next Annual Convention, have to report :

That on October 10th last, a circular was sent to each Member of the Society, asking him to name such time and place as he preferred ; 49 replies were received, some of which were incomplete.

A canvass of votes thus cast, showed in reference to the time. 20 named May ; 12, June, and 1 each, March, July or November. Similarly in reference to place : 14 named New York ; 6 each Boston, Providence or Philadelphia ; 3 each Cleveland or San Francisco ; 2 each Pittsburgh, Baltimore or St. Louis, and 1 Milwaukee.

From this it will be seen that a time or place has not been named by a majority of votes cast ; the committee therefore recommends that members present, who desire to do so, may have an opportunity to state briefly reasons for preferring the time or place they name ; that a ballot be then taken and that the time and place of the next Annual Convention shall be as thus named by the most votes.

Respectfully submitted,

CHARLES MACDONALD,

Chairman of Committee.

November 5th, 1873.

## ADDRESS

OF THE PRESIDENT, COL. JULIUS W. ADAMS, TO THE SOCIETY.

On the occasion of assuming the chair as your presiding officer, and in view of some changes in the Constitution of the Society, and other matters of general interest now presented for the first time, I beg leave to submit a few remarks on these points, which I trust, will not be without interest to some of our members.

The report of the Board of Direction for the last year exhibits a healthy state of our finances, considering the difficulties under which we have labored, of a large increase in our yearly expenses. A diversity of opinion exists however among members, as to how far we may safely anticipate our revenue, in ordering an expenditure of moneys not yet received. It has been urged that the strength of an institution, to meet emergencies, is truly measured by its money reserve. In fact, without some such reserve, we are always tottering on the verge of bankruptcy; and the members of conservative tendencies may well hold to the opinion, that until such a reserve be secured beyond peradventure, we can at no time feel assured of the life of the institution.

But there is another class of members who view this matter in a totally different light, and who argue that the final success of such an institution as ours will be better assured by expending in its infancy all its available means in the spread of professional information, estimating as a result which may be anticipated to flow from a liberal expenditure in this direction, the enlisting the more hearty support and co-operation of the members of the profession throughout the country, who will, in this movement, see an earnest of the intention of the Society in their behalf.

At the unusually large Annual Meeting of the 5th inst., the majority present were of this latter opinion, and accordingly voted in favor of a more extended scheme of monthly publication than we have hitherto ventured to embark in, and I have reason to believe that a large majority of the members concur in this opinion. Whether we shall be able to accomplish all we aim at, without serious embarrassment to the Society, remains to be seen. The Committee on library having the matter of publication in charge, has been selected in view of their undoubted qualifications for the duties imposed upon them, and from their known ability and energy, if tempered with a proper discretion, the happiest results may be anticipated towards extending the influence and usefulness of the Society; I would impress upon members the fact, however, that without their individual exertion, we cannot hope of success. To print a monthly of 48 pages, which shall be acceptable to the Society at large, cannot be effected without we are in possession of the papers.

The contribution of original papers from members will not keep pace with the above rate of publication, unless more original matter be furnished; and while each individual member will admit the truth of this,

yet, presuming the conviction to be equally strong with others as with themselves, it is feared that each may trust that the needed contribution will be had without further exertion on his own part. Selected matter, to a limited extent, may be embraced in each monthly number; but if these are to be considered as representing the Proceedings solely of the Society, as is desirable they should, the selected matter should be a minimum, embracing only such extracts from new publications as is desirable, in order to a better understanding of a brief review of their contents for the use of members.

Thus it will appear that unless members exert themselves more than they have done hitherto, in the preparation of original papers, the Committee will be forced to a selection from second-hand matter, in order to prepare a monthly publication of the extent called for. As to the description of papers which members are expected to furnish, and their ease of preparation, I can add nothing to the force of what has already been well said by a former President of the Society, Mr. Kirkwood, in his address on taking the chair, November, 1867, to which I beg leave to refer you.\*

The certificate of membership, prepared in accordance with a resolution of the Society some time since, is now nearly complete, and the diplomas will be issued to members so soon as the necessary arrangements can be effected.

It is anticipated that this evidence of our brotherhood in the possession of each member will be prized by him on that account, aside from the value as a diploma evidencing professional qualifications, emanating from the only body of men whom they recognize as qualified for the expression of an opinion on professional merit, and some degree of advantage to the strength of the Society may be anticipated from this fact of the issue of diplomas, as being an inducement for the younger members of the profession throughout the country to qualify themselves for admission to the Society, which confers, as it were, National rank.

By the Constitution, as now amended, no further change can be made in that instrument prior to the next Annual Meeting. The election of members by written ballot, thus giving non-residents a voice in the affairs of the Society, is included among the amendments; but there are still defects in the Constitution, and as it is desirable that this matter should be set at rest, once for all, a committee has been appointed to present at the next Annual Meeting the draft of a complete Constitution, making as little change in the present one as is consistent with our wants, but embodying all the requirements which our past experience points out as desirable, and it is hoped that the thoughtful, careful study which will be expended on the preparation of this paper, will leave nothing to be desired, for many years to come, in the way of change in the organic law of the Society.

The division of the active members of the Society into three, instead of two classes, as heretofore, is deemed a wise change, in view of the

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\* Transactions—Address of the President, Dec. 4th, 1867.

future growth of the Society; but unless the Board of Direction be required, as heretofore, to canvass the merits of applicants, there is great reason to fear that personal friendship may, in many cases, lead members, in endorsing applications, to overlook defects of character or education in individuals which should disqualify them for membership. Time and experience may be expected to diminish the force of the latter objection, but the former may be irremediable.

It should be recollected that this Society is not a school for the training of young engineers, but an institution claiming the authority to determine what shall constitute the qualifications, moral and technical, of members of the "American Society of Civil Engineers," and to issue to such, diplomas as the evidence, under the broad seal of the Society, that they come up to that standard; recollecting always the advice of Telford, "that talents and respectability are preferable to numbers, and that "from too easy and promiscuous admissions, unavoidable, and not unfrequently incurable, inconveniences perplex most societies."

Some years since, when it was proposed to drop the word "architect" from our title of incorporation, I prepared a paper in advocacy of the change, which was read before the Society, but the purpose being served, the paper was withheld from publication. I beg leave to insert here some extracts from that paper, as possibly of some interest to the younger members of the Society.

In the year 1828 or '30, a friend of mine was placed under the guardianship of his uncle, a well-to-do merchant of Boston, and one who, having made his fortune by his own exertions (and in a community where they are supposed to know, or at all events claim to know, whatever is worth knowing), was entitled to be regarded as a good, practical, common-sense man. His nephew, having given the matter due consideration in his own mind, sought his guardian one morning to state to him his determination in reference to the choice which he had made of a profession. Said he, "Uncle, I want to be a Civil Engineer." "A what?" said his uncle, regarding him with a look of amazement. "A Civil Engineer," said the lad. "What the — is that?" responded the uncle—and sent him to sea before the mast, as a common sailor—a means not uncommonly resorted to in that part of the country to reclaim, and restore to society, subjects supposed to be given over to the vagaries of wild or erratic delusions, or, as they are pleased to call it there, "to steady them."

This respectable merchant knew what an architect was, and had a vague idea, perhaps, of the engineer of a fire department or a steam-boat, but as to a Civil Engineer, he neither knew the name nor functions, and indeed, in this country, at that time, their number could have been counted on the fingers of your hand.

With the subsequent career of the lad, singularly checkered as it was, and filled with adventure in all parts of the world, until at length he was enabled to gratify his early wish, that of becoming a Civil



Engineer, we have nothing to do. I have introduced this anecdote to illustrate the fact, that some forty years since, not only was the profession of a Civil Engineer but little known in this country, but that intelligent business men considered it unbecoming for an educated, enterprising young man to endeavor and fit himself for its practice. To be sure this was not the case to the same extent in older countries at that time, owing to their greater progress and means for improvement; but when we consider the obvious benefits to be anticipated from the labors of the engineer in a new country, it seems remarkable, at first sight, that the profession was not recognized at an earlier day.

Civil Engineering, in the sense in which we use the term, is entirely a modern science, the practice of which as a distinct profession, has grown out of the wants induced by modern refinement and culture, and the more luxurious habits and comforts which, no longer confined to the governing classes, but extending throughout society, as the condition of the masses were bettered, have become among the necessities of life.

The magnificent works of the ancients which still remain to us are less monuments of the enterprise of the people, than of the power of their rulers—some of them so vast that the resources of a kingdom would hardly suffice for their erection at the present day, were yet constructed at a time when their builders were content themselves to live in hovels; and though the architect has flourished, and his works for ages back attest his genius and the claims of his art to our consideration, it was not until the engineer stepped upon the stage that his labors had any other value than as they exhibited the perfection and beauty to which the art of construction could be carried.

The advent of the engineer was the dawn of *progress* in the world's history, so far as the amelioration of the condition of the masses and the freeing of man from the shackles of ignorance and prejudice were concerned.

It is a question that has been much discussed, whether indeed the architect has made a single advance in his art since the days of Pericles (400 B.C.). Certain it is, that his step is scarcely audible to us, whilst the colossal strides of the engineer are thundering in our ears on every side.

I admit the architect's claim to priority in the practice of his own profession, as well as ours. It is too patent to be denied that he is the "chief of the workmen," for such, according to DeQuincy, is the meaning of the term—architect, as derived from the Greek word, "archos" and tekton," or, "one who superintends a building." His labors as a builder merely, grew out of the necessities of our nature, and were coeval with civilization itself; next, as art became engrafted on his practice, he ministered to the luxury of a class, whose end and aim was to preserve the existing barriers between the few and the many, but was powerless of himself to advance the material interests of the lower classes; but now, these barriers are being swept away, and in the pro-

gress of improvement and diffusion of knowledge, the Civil Engineer leads, where formerly he was content to follow.

The science of construction in all its ramifications, however essential it may be to the Architect for embodying his ideas, yet, is entirely within the province of the Civil Engineer ; whilst the decorative branch of art merely is all that properly belongs to the architect as his specialty.

In the present paper I propose :

*First.*—To show very briefly, for the consideration of the junior members of the Society, that in the earlier ages, the functions of the Civil Engineer were exercised by the architect. Engineering consisted at that date in devising and operating machines merely, as auxiliary to, and under the direction of the architect.

*Second.*—The architects of the middle ages, as a society, by means of association and union among themselves, finally became possessed of a power which has left an impress on the architectural art of Europe, that for centuries yet to come, will be a source of wonder and speculation to the student.

*Third.*—Glancing at the state of the mechanic arts, and the status of the engineers in England a little more than a century since, and the efforts of a few gifted individuals in giving direction to public enterprise, and a name to the profession which they practiced, we wish to show the further evidences of the value of association in securing the benefits to the profession at large of the honorable position to which they had arrived by their personal efforts ; and by inference to indicate the means by which we may reasonably hope to retain the commanding position they have secured for us.

Not to be too tiresome, I shall not multiply examples needlessly to prove that the engineer, if he appeared at all in those days, did so as the operative man under the architect. The names of the former never appeared save in military operations, and then but as the constructor and manager of machines, never as the constructor of the works, either of offense or defense. The names of the architects have in many cases been preserved to us, but in by far the greater number of cases they have been lost in the blaze of glory which envelopes the imperial projectors of the works.

After Alexander's conquest, he having journeyed through Egypt, and noting the advanced state of the country in the arts, and its great productiveness, determined to build a capital at the mouth of the Nile. The scale upon which the works were projected was enormous ; causeways, dykes, light-houses, arsenals, sea-walls,—the latter encircling the city in three distinct walls of squared stone, 40 feet in height, defended by lofty towers, ten stories in height—cisterns and conduits of stone lined with cement (still to be seen), water works and works of drainage ; and making every allowance for possible exaggeration in the various historians who have described it, the city was but second to ancient Rome, in its extent and magnificence. Here was a place for the employment of a Civil Engi-



neer, if such an individual was to be found ; particularly as we are informed of Alexander, that he had the rare faculty of judging of the best men to execute his bold designs. On this occasion, he appointed Dinocrates his architect, and we are left in no doubt as to whether the word architect does not in truth mean engineer, for we are told that this Dinocrates had already acquired great celebrity in the construction of the Temple of Diana at Ephesus, an undoubted architectural work. The Island of Pharos served as a breakwater to the harbor of Alexandria, and upon this was erected by Sostratus of Cuidos a light-house 450 feet in height, to be seen a distance of 100 miles, which was long considered one of the wonders of the world, and has given a name to all others. This Sostratus was the architect of one of Alexander's successors—Ptolemy Philadelphus.

When it was decided to rebuild the famous "long walls," of which we hear so much in the history of Greece, as connecting the port (Piræus) with Athens, and to construct arsenals sufficiently extensive to house the whole Grecian navy, with all their stores and material, the famous architect Philo of Athens was charged with the work. This work was of cut stone clamped with iron and run with lead, and you will recollect was wide enough to allow carriages to pass, and some 60 feet high and some 24 miles in length, including the circuit of the port and city—what we should call a work of engineering. This was completed in the time of Pericles, by the architect Callicrates, who also assisted Ictinus in the construction of the far famed and immortal Parthenon. This same architect built the fortifications around the port of Athens.

The Island of Rhodes was settled by Greeks, and for centuries was famous for the study of the sciences. The city of the same name built on this island, was a flourishing and opulent city, and was fortified in a most elaborate manner ; and we read that when Demetrius Poliorcetes, or "city taken" as he was called, son of the king of Macedon, laid siege to it, Diognetus the architect was paid an annual salary for his skill in maintaining the walls and places of defense.

Plutarch says that Demetrius himself had a thorough knowledge of mechanics, and devised, amongst other machines, a "helipolis," so named from its use in taking cities—a huge frame-work of timber and iron covered with hides and hair-cloth to withstand the shock of a 360 pound weight, thrown from a ballista and that these machines were made by one Epimachus, an Athenian whom he had in his train—but this man is not spoken of as architect or engineer, and we hear no more of him during the siege, but learn that Callios, an architect of Aradus, arrived in the city and exhibited a model of a wall with a revolving crane, by means of which he proposed to grapple and suspend a "helipolis" and swing it within the walls. Diognetus was on this dismissed, and Callios employed in his stead, but he failed to carry out his promises. Diognetus was then entreated to resume the direction of the works, which he did on his own

terms. The operations of the siege are described at some length in Cresy's History of Engineering as favorable to the besieged; and the repulsed general so admired the skill in defense exhibited by the architect that he gave to the city the engines he had used to reduce it, and it was from the proceeds of the sale of them that they built the famous "Colossus" of Rhodes, considered one of the seven wonders of the world.

Archimides, who was killed at the siege of Syracuse, about 200 B.C., is indeed spoken of by *moderns* as the "famous engineer" whose skill protracted the siege of this city, but he is invariably alluded to by early writers as the mathematician and geometer. If he did not found the School of Philosophers at Alexandria, he studied there, and his disciples, Ctesibius and Hero, neither of whom were engineers, but writers on mechanics, perfected (possibly by his aid) several hydraulic machines, and are invariably spoken of as philosophers who perfected the principles of mechanics as taught by Archimedes. Belidere informs us that Archimedes studied for his own gratification, and it was only at the instance of the king of Syracuse, when it was besieged by the Romans, that he consented to exert his great talents for any public use.

Rome had existed about 400 years, but her great works were as yet in their infancy. The immense extent of their roads, their duration, the obstacles which they surmounted in carrying them over marshes, lakes, rivers and mountains, have in all ages excited astonishment and admiration, and rank pre-eminently high as engineering works.

The Appian Way was the first paved road of the Romans, commenced by the Consul Appius Claudius, who was honored with the highest offices of the government, some 300 years before our era; some of it exists at the present day in perfect condition. Such arteries from the heart of the imperial city were not thought unworthy of the attention of the greatest men of the republic, and none but those of the highest rank were ever eligible to the office of superintendency.

Plutarch mentions that Julius Caesar was appointed commissary of this road, and expended large sums of money in extending it, and we are told that the Emperor Augustine himself took the personal charge of the public roads in his day, but we hear of no engineer. Again, in the construction of the magnificent works for supplying the Imperial city, and important cities of the provinces with water, the remains of which now existing excite our wonder, we find the same indifference manifested as to who was the engineer.

Sextus Julius Frontinus was prætor at Rome in the year 70, and held the office of proconsul when he was appointed to superintend the Roman aqueducts; and during the time he held the office, for the benefit of his successor, he compiled the work entitled "De Aqueductibus urbis Romæ," which contained an account of the nine aqueducts then built (four of them are still in serviceable condition), as well as the names of all the waters brought to Rome, and by what consuls, from what sources, what length of tunnel, on what arches, their height and breadth, the details

within the city, the quantities of water delivered in the several sections of the city by measuring the number and dimensions of the reservoirs, private as well as public, the penalties imposed by decree of the Senate, or commands of the Emperor upon individuals for committing any trespass upon the works—everything in fact of importance that bore in any way upon the works, but not a word of the engineer! And yet we know the name of the plumber who was engaged upon the distribution—the leaden pipe stamped with his name being still in existence, and in the remains of the Roman Aqueduct, near Lyons, leaden pipe some 15 or 20 feet in length is found stamped with the name of Tiberius Claudius Caesar.

Pliny, in one of his letters to the Emperor Trajan says, that the inhabitants of the City Nicomedia had expended 3,000,000 sesterces in building an aqueduct, which was a failure, and was abandoned to ruin, and a second attempt, at an expenditure of 2,000,000 sesterces had also failed, and requested him, after stating his own views as to how the thing should be done, viz., on arches of brick, &c., to send some *engineers* (so it is translated to us by Cresy in his History of Engineering), skilled in the management of water works, to undertake the construction.

Dalloway, a classical scholar, in his discourses on architecture, also quotes this letter, and the expression used by Pliny, *collegium fabrorum*, which he translates "College of Artificers;" but whatever discrepancy there may be in translating the meaning of Pliny, there is none in the answer of the Emperor Trajan, who replies that every province is provided with men of skill and ingenuity, and that Greece supplied most of the *architects* that came to Rome; evidently regarding the latter class of professional men as the proper directors of such work.

Cresy, in his History of Engineering, says that "we learn from the ancient historians that the architect had entrusted to him, not only the defenses of the towns and cities, but also their arrangement, drainage and general superintendence; we may infer that there existed no distinction between him and the engineer." But I do not so read history, and consider the conclusion to which he arrives, as unwarranted by the facts. There was a distinction, and the higher rank was assigned the architect.

I cannot learn that the term engineer was applied to the direction of any public works, whether civil or military, until modern times.

We come now to a period in history when, if the architect was not already supreme, he soon became so, and here we shall see the value of association.

Torn by internal faction, and enervated alike morally and physically by her many triumphs, Rome slowly succumbed to the barbarous hordes which were poured from the north upon the world. All art was stagnated, frozen by their chill influence, and a long and dark winter then ensued, what we now call the dark ages.

When Constantine removed the seat of empire from Rome to Byzantium or Constantinople, as it is called, in the early part of the fourth century the last blow was given to imperial Rome.

Gibbon, the historian, says, "Constantine employed the whole energy of the nation to beautify and adorn the new city. A multitude of laborers and artificers urged the conclusion of this work with incessant toil. The impatience of the emperor soon discovered that in the decline of the arts, the skill as well as numbers of his architects bore a very unequal proportion to the greatness of his designs, and the authorities of the most distant provinces were therefore directed to institute schools, to appoint professors, and by the hopes of reward and privileges, to engage in the study and practice of architecture a sufficient number of the ingenious youth who had received a liberal education." This law is dated A. D. 334, and was addressed to the prefect of all Italy, whose jurisdiction extended even to Africa. The result was, that Constantinople became the centre of cultivation and art. The sciences flourished there in a greater degree than elsewhere, and her men of learning were sought by European as well as Asiatic nations, and her architecture was copied on all sides; many of its features came westward beyond the Alps, and were taken up by the Lombards, and here was first formed that remarkable association of working architects, who under the name of Free and Accepted Masons, reared those gorgeous monuments of art, the cathedral churches of Italy, Germany, France and England; displaying the most delicate workmanship, the richest fancy, the most cultivated taste and judgment, and the profoundest mathematical skill; the problem, which we, as engineers are daily puzzled with, viz., with a minimum of materials to produce a maximum effect, everywhere so admirably solved by them, shows an advancement in constructive skill, equal at least to anything of which we can boast, even at this day, and this at a time when the grossest ignorance prevailed: few could even read; to be able to write entitled one to the appellation of scholar, and the knowledge of a few elementary principles in physic oftentimes proved but a passport to the stake. Hallam, a writer on the middle ages, relates that the Emperor Frederick Barbarossa could not read, nor could John, King of Bohemia, in 1550, nor Philip the Hardy, King of France. Science and art was a monopoly with this one body of men, which numbered in its ranks, not the laymen merely, but ecclesiastics of the highest rank; no one was admitted into the craft unless properly qualified, and duly examined, and signs and tokens were entrusted to them by which they were enabled to show that they were skillful craftsmen, and obtained employment wherever they went, without being required to undergo further examination as to their masonic qualifications.

The early history of this remarkable body of men (perhaps owing to the strict secrecy under which all their proceedings were conducted) is involved in some obscurity. It would be very interesting were we architects, to search the authorities, and thence trace their progress throughout Europe, when perfecting that beautiful style of architecture which we misname Gothic; but it is foreign to our purpose, and it will be sufficient to say that after the building of the church of Aix la Chapelle by

Charlemagne, who himself died in the year 813, the existence of this fraternity, under the title of Freemasons, and their astonishing labors in covering the land with their monuments, is no longer doubtful ; and the pointed style rose simultaneously under their hands in Germany, France and England, and at a time when international intercourse was almost entirely interrupted. Yet, an artist can trace in these buildings the growth of the style during their construction (which occupied centuries in some cases), shown by an almost simultaneous introduction of changes in details, and although to appearances in each country preserving a national distinction from others, yet exhibiting the evidences, in spirit and touch, of a master hand common to all. So multiplied did their labors become, that their numbers were found inadequate to the demands upon them, and the church of Rome, seeing the importance of their work, as a part of its machinery, took measures to swell their ranks by endowing them with rights and immunities, forbidding competition to native artists, unless members of the fraternity, exempting them from all local enactments, allowing them to fix their own rate of compensation, and threatening with excommunication all who interfered with their privileges, &c. This, at first, had the desired effect, and Greek, Flemish, Italian and German artists joined the main body, and were initiated into its mysteries. To enumerate the works of the Freemasons of the middle ages, would be to speak of nearly all the edifices constructed during several centuries, and their titles alone would fill a volume ; but the ecclesiastical element introduced proved the beginning of mischief to the craft, and in the sixteenth century Freemasonry had found its meridian, but continued to remain the shadow of itself until the end of the seventeenth century, when a proposition having passed, that its privileges should no longer be confined to operative masons, but extend to men of all professions, it became immediately changed in its essential points, and soon ceased to claim any connection with the arts of construction.

To one who has not made the subject something of a study, the almost miraculous achievements of those men when in their zenith, effected by the one principle of *union*, can scarcely be appreciated. But the lesson taught us by the success is a plain one—a union of feeling and interest that should render the knowledge acquired by one the property of all—and the subordination of private interests to the advancement of the craft.

In the meantime necessity brought up the consideration of a branch of our profession which had been neglected in the anarchy which prevailed throughout the States of Europe at that day. The rivers had been neglected, their beds became elevated, and their openings to the sea filled up. Ravenna is now five miles, Rimini one mile, and Adria nineteen miles from the coast, and each of these places ranked as ports of importance in the time of the Romans ; and as the beds of the rivers rose, they had been compelled to raise the banks, and when, from neglect, these gave way, the whole country became one vast lagoon or swamp. These terrible inundations alarmed the whole of the inhab-

itants of this part of Italy, including the rich plains of Lombardy. The evils daily increasing, the most eminent *scholars* were consulted upon the occasion, for Cresy says, in his History of Engineering, "that before the seventeenth century there were scarcely any principles laid down to direct the civil engineer, and Europe could hardly boast of an eminent man in that profession," and he says that it was highly fortunate for the world in general, that these disasters directed the labors of the greatest philosophers of the age, when science began to revive, to the study of "hydraulic architecture."

Leonardo da Vinci (the painter of the Last Supper), about the middle of the 15th century, and Raphael and Michael Angelo, were not more distinguished as artists than as architects; the last also employed his great talents in fortifying his native city, and the former astonished his contemporaries by investigations which were entirely unknown to the philosophers of the times.

If he did not invent the canal lock with gates as at present, he at all events united the two canals of Milan by means of six such locks in the year 1497, as an inscription on one of the sluices states [to the two brothers Domenico (1481), clock makers, is attributed the invention]; previous to which, and for a long time after, and in England until near 1600, weirs or flashes were used, both in canal and still water navigation. Men of letters and scientific students made "hydraulic architecture," as it was termed, a study; and we read as late as 1720, that the "republic of Venice always appointed two of its most eminent philosophers to act as engineers and maintain the water courses of the city in proper condition."

The public works of the continent of Europe were in almost all cases directed by the governments, and we must look to England for the evidence of the results of the unfettered enterprise of individuals. When Smeaton was born, in 1724, to whose genius and exertions civil engineering owes its establishment as a profession in England, the state of the country is thus described: "There were no canals, railways, nor artificial harbors, no machinery which at the present day would be thought worthy of the name, and the public roads were little better than tracks across the country, communication between towns was difficult, and the luxuries and even necessities of life difficult of attainment." As late as 1754, the flying coach was advertised, "that, incredible as it might appear, it promised to deliver passengers in London in 4½ days!—185 miles." Inland navigation, which was carried on in the rivers as nature had left them, was tedious and uncertain; in some cases flash weirs were in use, and in some, but very rarely, side cuts had been made, and the pond-lock introduced, with a waste weir to supply mills. Wind-mills, to the improvement of which Smeaton directed his attention, was a large source of power, and to his improvement in both water and wind-mills, we may date the foundation of the modern system of manufacturing; better roads became necessary to carry away the increased



products of the mills, and the water-mill owners themselves became also interested in the improvement of the navigation.

Brindley, who is regarded as the father of canal navigation in England, was born in 1716. He was a millwright, and left that business in 1758 to undertake the Duke of Bridgewater's canal, which was rapidly followed or rather accompanied by others, and in conjunction with Smeaton, so successful was their work, that the river navigation was entirely superseded by canals; their effect in diminishing the cost of all necessities, as well as luxuries of life, was shown in the rapid increase in the wealth and prosperity of every part of the kingdom. Smeaton had commenced his career as a mathematical instrument maker in 1750; in 1765 he directed his attention to the steam-engine, and had made valuable improvements when the immortal Watt appeared upon the stage. Watt was born in 1736; he was also bred as a mathematical instrument maker, but became an engineer previous to directing his attention to the steam-engine. Instead of being satisfied with making improvements on existing engines, he boldly struck out for himself, and made this machine really what it had only been in name—a steam-engine; and passing by his various inventions and improvements, we come to 1784, when he erected the first engine used for mills (Albion mills), and the first cotton mill driven by steam was erected in 1785. Thus, the fact was established of its economical availability for the propulsion of machinery of all kinds. Here was the magician's wand, which was destined so soon to revolutionize the whole face of nature—but one thing more was wanting.

The rapid spread of manufactures soon created new wants, and commerce increasing in like proportion, the insufficiency of the means of internal transport soon made itself felt; protected from all competition by the imperfect nature of the public roads, the rival lines of canals built to remedy this evil of monopoly only added to it, and combination amongst them, left the public the victims, and necessity engendered negligence on their part. Lardner says that in a petition addressed to Parliament in 1825, evidence was offered that the cotton, which then crossed the ocean in twenty days, or thereabouts, took six weeks to reach the mills in Manchester!—only 30 miles distant. A railroad was determined on for the transport of freight solely, such roads having been some years in use near the collieries for the transport of coal. The act of incorporation was obtained in 1828, and George Stephenson was appointed the engineer. The wide-known competition as to the power to be used then followed, with a result so astounding that men for awhile held their breath, the annihilation of time and space, comparatively speaking—was equivalent to a new lease of life. The men who were instrumental in conferring these benefits were demi-gods, and the field of employment so suddenly enlarged, called for a new order of professional men, and the Civil Engineer, for the first time, appears in his true light, and with becoming dignity. The practical skill and experience of the engineering profession could not keep pace with the increasing demand of the public

and the avidity of capitalists. Enterprises were pushed forward before time had ripened the results of the earlier attempts into general principles, and the limited number of Civil Engineers, who could call themselves such, were soon engrossed to the full extent of their time and powers, great enterprises fell under the superintendence of men deficient alike in the requisite training and in the capacity to conduct great works, and but for the institution of the Society of Civil Engineers, which had been some years in existence at this time, the achievements of such men as Smeaton, Brindly, Telford, the Rennies, the Stephenson's, Chapman, Jessup, Grundy, Walker and a host of men who have passed away, would have been lost to us as common property in which we could take professional pride—for the profession, as one to be proud of, would probably have passed away with them.

It is true it was private study, and not the diploma of any institute, that produced these men, and gave a character to the science which they practiced, but it was the association which they formed which permanently established it as a profession.

Whether or not these men, with a prophetic eye to the abuses to which the great demand for engineers would give rise, sought to apply the remedy, by fixing the qualification of its members, I am unable to say, but certain it is, that it has contributed largely to that end; and if we will glance at the constitution of that Society, and the papers relating to it, now on your table, it will be seen that, so far as is consistent with proper individual liberty, they have introduced conservative elements, which are well calculated to establish the permanency of the profession, and perpetuate its usefulness on a basis alike beneficial to the members of the association and to the public at large.

The present English Institution of Civil Engineers owes its existence to Smeaton. The first meetings of the association then formed, and since called by his name, took place in 1771. They took place for a long time at a tavern, and were of the character of a club, until, in 1793, when a Society was formed; although its members were the most eminent men of the day, its constitution was too exclusive to do much towards elevating the character of the profession; nothing was arrived at further than a pleasant union of men, whose positions were already well established, and no provision was made, or attempted, for the improvement of the younger members of the profession, and it was soon seen, that an institution on a larger scale—one having in view the furtherance of professional knowledge—would be useful, and was indeed due to the profession from those engaged in it. Accordingly in 1817, some practical engineers, impressed with the difficulties with which they contended, in endeavoring to obtain the knowledge requisite for the diversified practices of engineering, resolved to form themselves into a society, and thus profit by the interchange of individual observation and experience. The meetings were held at a tavern in London, and so continued for two years, without any considerable in-



crease of numbers, when it was determined to request Thomas Telford to take upon himself the position of president, and lend the influence of his name in furthering the objects of the Society, which was incorporated by royal charter in 1828, and now numbers amongst its members every engineer of any note in England, and many in other countries; and so wide spread is its influence, that no scheme of improvement has the slightest chance for success unless the engineer who advocates it be a member of the Institution of Civil Engineers.

What are the facts with us? It is true that, notwithstanding our youth and inexperience, great works have been executed in this country, works which will compare creditably with those of the same class in older countries, but the profession has not been elevated correspondingly. Any one is free to propose himself as the engineer of the most intricate schemes of improvement, and if any question arises as to the fitness of the man, it is more likely to resolve itself into *who* are his friends, rather than *what* are his plans. That this should be so often the case is partly attributable to the ignorance or indifference on the part of the public as to the requisite preparations or qualifications of Civil Engineers, which possibly grows out of the slightness of the professional bond which at present unites them, and the little individual interest they appear to manifest in the advancement of their profession.

We have seen the effect of union in the case of the architect masons of the middle ages, and of association in the Civil Engineers of England, and we may fairly presume that similar means, properly applied in our own case, will be promotive of a similar result. The attempt has frequently been made, but has heretofore failed with us, from lack of individual exertion; members have cheerfully paid their dues, and supposed by so doing all their responsibility as to results ceases, but unless members have determined to place their profession (the Society) on the footing which its importance demands, and use the proper means to that end, the result will be as it always heretofore has been, a failure. None but its members are especially interested in seeing the Society honored and respected; of course the public will be slow to confer honors which have not been thought worthy an effort, and unless earnest individual efforts be made, we cannot hope to become a living body.

In conclusion, permit me to quote, for the benefit of our Juniors, from Goodwin's History of the Mason Architects of the Middle Ages, a few extracts from the rules and regulations established for their guidance:

"Let no master take on him no lord's worke, nor any other man's, unless he know himself well able to perform that worke, so that the craft have no slander." Another enjoins "not to supersede a brother mason, or to worke for less than the established rate." A third impresses the "necessity of modesty of behavior and general kindness to all men."

## ANNOUNCEMENTS.

NOTES AND QUERIES.—It is proposed to include under this head questions and replies relating to the theory and practice of engineering, contributed by members.

Q. 1. Is there a durable paint or coating which will protect woodwork in any considerable degree from fire ; if so, particulars in reference to its composition, length of trial and cost are desired.

Q. 2. Giving the weight of a bridge draw-span, or railway turn-table: *First*, If sustained upon wheels, what should be their diameter and face ; and, *Second*, If sustained upon an anti-friction pivot, what should be the diameter of the pivot, the length and greater diameter of the anti-friction rollers ; their dimensions being such as will permit the least friction and the greatest economy of material, with a *maximum* endurance of surfaces in rolling contact.

A LIST OF NEW ENGINEERING AND TECHNICAL BOOKS,—English, French and German, and brief examinations of the more important, by members familiar with the subjects treated, will be published in the January number of "Transactions," and continued monthly afterward.

PAPERS AND DISCUSSIONS.—It is intended to announce subjects for consideration at future meetings of the Society, in an early number of "Transactions," and regularly afterward, so that non-residents may take part, either in person or by communicating with the Secretary. Members are requested to give early notice when and upon what subjects they will contribute Papers ; and those seeking information are asked to suggest professional topics for discussion. There is much in the current experience of any practical engineer interesting and profitable to others in the profession. If each member of the Society will communicate, at least once a year, an account of something which he, or others within his knowledge, has learned or accomplished, the aggregate collection of information will in time be of great value, and comprise much otherwise quite inaccessible to engineers generally.

Comments and discussions on Papers herein published are solicited. It is hoped each member, whether present at meetings of the Society or not, will communicate, for publication in future numbers of "Transactions," what his experience teaches of the subjects considered.

MEETINGS.—The next afternoon meeting of the Society will be held Wednesday, December 3d, at one o'clock P. M., when the Committee to revise the By-Laws will report.

The next evening meeting of the Society will be held Wednesday, December 17th, at eight o'clock P. M., at which a paper describing a "Plan adopted for Raising a Draw-span, after the False-works were Carried Away," by C. S. Maurice, C. E., of New York, will be read.

# AMERICAN SOCIETY OF CIVIL ENGINEERS.

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## PROCEEDINGS.

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### MINUTES OF MEETINGS.

(Abstract of such as may be of general interest to members.)

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#### OF THE SOCIETY.

NOVEMBER 19TH, 1873.—A regular meeting was held at 8 o'clock P. M.; attention was called to the resolution adopted November 5th last, whereby the evening meetings were devoted exclusively to professional improvement and the encouragement of social intercourse among men of practical science, and it was decided that a formal organization was unnecessary.

A "Note on the Resistance of Materials," by Prof. Robert H. Thurston, of Hoboken, N. J.,\* was read, and followed by discussion.

A communication† from Gen. W. Sooy Smith, Chairman of the committee "appointed to urge upon the United States Government the importance of a thorough and complete series of tests upon American iron and steel, and the great value of formulæ to be deduced from such experiments," was presented.

It was remarked, an appropriation of \$40,000 was at the last session of Congress given to the Ordnance Department of the U. S. Army, for making tests of iron and steel, and the Emery testing machine had been recommended for the purpose. The Bureau of Ordnance, U. S. Navy, and other co-ordinate branches of the government are interested in similar experiments.

The great importance of correct and exhaustive tests to establish what is the safe resistance of materials used by engineers, under the conditions of common practice, is generally felt by them, and doubtless would be recognized by Congress when properly laid before it. Few, except engineers, understand how little is positively known of the strength of American iron and steel, in pieces of the size and form, and under the strains, of the parts which make up some important structures.

To successfully experiment upon specimens large enough to determine how full sized pieces will behave when similarly strained, and to include

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\* Herewith published as LXI Transactions.

† Received after the Annual Meeting.

in the series of trials, the many shapes now employed, will require an expenditure of time and money, quite beyond the means of any person or firm, even if the result thus obtained, first for private or personal uses, would be accepted by the profession at large, without allowance.

Such investigations should be conducted at government expense, under experienced and intelligent supervision; the results would not only augment precise knowledge—they would also increase the value of the material products of the country.

Members were urged to give the matter full consideration, and—as far as they could do so—co-operate with the committee in securing the results desired.

The proportions of wheels and rollers, under swing bridges and similar structures were considered.

DECEMBER 3D, 1873.—A regular meeting was held at 2 o'clock P. M.; the following from the Board of Direction was presented:

“Resolved—this Board hereby recommends to the Society for adoption, that for a Junior, during the year 1873-74, the entrance fee shall be \$20, and the annual assessment \$10.” The recommendation was accepted, and notice given, under Art. XXIII of the Constitution, that it would be called up for adoption, at the meeting to be held January 7th, next.

Gen. George S. Greene, Chairman of the committee appointed at the Annual Meeting to revise the By-laws of the Society, presented a report, which was accepted, and a motion was made that the By-laws therein recommended for repeal be repealed, and those recommended for adoption be adopted, which was seconded, and action thereon set down for the meeting to be held January 7th next.

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#### OF THE BOARD OF DIRECTION.

NOVEMBER 25TH, 1873.—An adjourned meeting was held at 2 o'clock P. M. Consideration of the requirements of Honorary Membership, and a plan for transfer from the class of Associates or Juniors to that of Members, were referred to the committee appointed at the Annual Meeting to revise the By-laws. It was ordered that, pending the report of this committee, all applications for membership be submitted to the Board at the first regular meeting, for examination and action thereon, under Art. XIX of the Constitution. A form for letter ballot and a report in answer to the query—whether Associates already admitted shall remain such, be Juniors or become Members, with the draft of a letter to be sent to Associates, were adopted.

The Committee on Finance stated that the Treasurer's accounts for the year ending November 5th, 1873, had been audited, and his Annual Report approved; and made a report covering recommendations or rules for the

management of the financial business of the Society, which were adopted.

It was resolved that the regular meetings of the Board be held at 2 o'clock P.M., on the first Monday in each month, except July, and that when there is not a quorum, the President or a Vice-President, and other members of the Board present may act as a committee for the transaction of regular business.

The Secretary was directed to send several blank applications to each member, with a request to aid in the growth of the Society, by soliciting desirable persons to become members.

DECEMBER 1ST, 1873.—A regular meeting was held at 2 o'clock P. M.; proposals for admission to the Society were considered; it was resolved that whenever an applicant as Member, or "in blank" is classed as Associate or Junior, his consent shall be obtained before a ballot is ordered, and action to fix the fees and dues of Juniors was recommended to the Society.

The Committee on Norman Medal was requested to report, at the next meeting of the Board, a plan for awarding the prize; the Committee on Library was instructed to prepare a list of subjects relating to the practice of engineering, and its connection with kindred arts and public affairs, on which papers shall be solicited and discussions had; and to make timely announcement to the Society of the order in which these subjects will be taken up, so that non-residents may take part.

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## REPORTS.

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### OF THE COMMITTEE ON TESTS OF AMERICAN IRON AND STEEL.

Presented November 19th, 1873.

In accordance with the announcement and request that a statement would be made to the Society, at its approaching Annual Meeting, of what has been done by the committee on tests of American iron and steel, and what the committee proposed to do, I beg leave to submit the following report of progress, which I have been compelled to prepare without consultation with the other members of the committee, as they are so widely separated as to have been beyond my reach within the time granted for this report.

Soon after the appointment of the committee, a comparison of the views of its members as to the best method of securing the object for which it was appointed, was obtained by correspondence. From this comparison it seemed best to the members of the committee that all the facts obtainable, showing the value and importance of the tests proposed,

should be collected, and that a memorial to Congress, embodying these facts, should be prepared. On hearing that this was proposed by the committee, the Secretary of the Society suggested that he would ask the assistance of the members in gathering the facts, by a circular letter addressed to them by him. Whether such circular letter has been issued or not, the committee has not been informed.\* The suggestion was gladly accepted by the committee.

The tests and investigations proposed, to be of full value to our profession and to the country, should be thorough and exhaustive. To make them so, will require the expenditure of a large sum of money, and it will require the application to the work of the very best talent in the country for months, and perhaps years of time.

To awaken that deep interest in the subject which will prompt representatives in Congress to favor the necessary appropriation, a full presentation of the facts would seem very desirable, if not absolutely necessary. Much has been done already by the committee in getting together such materials for the memorial proposed, but the assistance of the entire Society is asked in order that every consideration may be presented that is based upon fact. As soon as the memorial can be prepared, it is proposed to submit it for the consideration of the Engineer Department of the government, in the hope that the assistance of that Department may be obtained in getting the desired action by Congress.

Much difficulty is experienced by the committee in its work, resulting from the fact that its members are widely separated and very actively engaged, and so the forbearance of the Society is asked if the progress made appears slow.

The subject has been quite fully explained to a number of Congressmen, who have assured us that they will give us their most earnest and active assistance. We cannot better conclude this statement than with a request that each member of the Society will immediately communicate by letter to the chairman of the committee such facts and considerations as he may think should be presented in the memorial proposed.

WM. SOOY SMITH,  
Chairman of Committee.

Booneville, Mo., Nov. 3d, 1873.

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#### OF THE COMMITTEE TO REVISE THE BY-LAWS.

Accepted December 3d, 1873.

The committee appointed at the last Annual Meeting "to revise the By-Laws of the Society, and make them correspond with the Constitu-

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\* It was included in circulars issued March 8th and 22d, 1873.

tion as amended," after full consideration of the subject thus referred to it, hereby recommend the following By-Laws for adoption:—

SECTION 1.—The regular meetings of the Society shall be held on the first Wednesday in each month. There shall be meetings of the Society held on the third Wednesday in each month "for professional improvement, and the encouragement of social intercourse among men of practical science," at which papers shall be read and subjects discussed relating to the theory and practice of engineering, and no other business transacted. The Board of Direction may suspend meetings of the Society in the months of July and August.

SECTION 2.—At the regular meetings of the Society the following order shall be observed in the transaction of business, unless set aside for the time being, by a vote of the Members present.

1st. The record of the last meeting to be read, approved and signed by the Chairman and Secretary.

2d. Candidates for membership to be balloted for.

3d. Communications received since the last regular meeting to be announced, and read if required.

4th. Communications from members present to be read.

5th. Communications from the Board of Direction to be brought forward.

6th. Reports of committees to be called for.

7th. Unfinished business to be taken up.

8th. New business to be proposed.

9th. Questions for debate to be discussed.

The same order shall be observed as far as practicable at the meetings of the Board of Direction.

SECTION 9.—The Board of Direction may call meetings of the Society when they deem it expedient, and shall be bound to do so at the written request of seven Members, stating the purpose of such meeting, Ten days' notice shall be given to Members of any special meeting; the purpose thereof shall be stated in the notice, and no other business shall be taken up at that meeting.

SECTION 10.—The rooms of the Society shall be open from 9 A. M. to 4 P. M. every business day, unless otherwise determined by the Board of Direction.

SECTION 13.—The books, maps and other property of the Society shall only be removed from the rooms under such rules and regulations as shall be prescribed by the Committee on Library, and approved by the Board of Direction.

SECTION 15.—The records of the Society shall at all times be open to Members, and such books of accounts shall be kept in its rooms as the Board of Direction may designate.

SECTION 16.—When a paper is presented to the Society, the Secretary shall at once examine it, and report thereon to the Committee on Library.



with reference to this standard: Papers containing old matter readily found elsewhere, those specially meant to advocate personal interests, those carelessly prepared or controverting established facts, and those purely speculative or foreign to the purposes of the Society, should be rejected. The committee shall then determine whether such paper may go before the Society. They can return it to the writer for correction and emendation, and call to their aid one or more members of special experience relating to the subject treated, either to advise on the paper or to discuss it. Such papers as in the judgment of the committee should go before the Society shall promptly, upon their acceptance, be printed; others shall be recorded in books provided for the purpose.

SECTION 17.—No indebtedness shall be incurred for the Society, except under such rules as prescribed by the Board of Direction.

SECTION 18.—No bill shall be paid for the Society until it has been certified by the person authorized to contract it, and audited by the Committee on Finance.

SECTION 19.—Moneys belonging to the Society, paid to any of its officers, shall, with a statement showing for what the payment was made, be promptly transmitted to the Treasurer, who shall receipt therefor.

SECTION 20.—The Treasurer shall deposit the moneys and invest the funds of the Society in its name, by and with the advice of the Board of Direction; he shall sign all checks.

SECTION 22.—The Board of Direction shall determine the order of its stated and special meetings; provide for an executive committee to act in the absence of a quorum, or during the intervals between the meetings; prescribe regulations for balloting, and generally conduct the business affairs of the Society. The record of the proceedings of the Board of Direction, made since the last regular meeting of the Society shall be read at each regular meeting.

SECTION 23.—Requirements for the several classes of membership shall be as follows:

1st. An Honorary Member shall be one of great knowledge and experience in some branch of engineering, who has had not less than thirty years' practice.

2d. A Corresponding Member shall be one not a resident of the United States, eminent in a special branch of engineering, or able to supply valuable information relating thereto, who will communicate with the Society at least once a year.

3d. A Member shall be a Civil, Military, Mining or Mechanical Engineer, who has been in active practice as such for seven years, (or has graduated as Civil Engineer and been in practice for five years), and has had responsible charge of work as Resident or Superintending Engineer for not less than one year.

4th. An Associate shall be a manager of a railroad, canal or other public work; a geologist, chemist or mathematician; a proprietor or man-

ager of a mine or metallurgical works; an architect or a manufacturer; who, from his scientific acquirements or practical experience, has attained eminence in his special pursuit, qualifying him to coöperate with engineers in the advancement of professional knowledge.

5th. A Junior shall be one between eighteen and twenty-eight years of age, who has had actual practice in some of the branches of civil, military, mining or mechanical engineering, for not less than two years; or, if a graduate of a scientific or collegiate institution, for not less than six months.

6th. A Fellow shall be an acceptable subscriber to the funds of the Society, who has signified to his proposers a desire to be nominated, and an intention, if elected, to become a member of this class.

SECTION 24.—Nominations and proposals for admission to the Society shall be endorsed by at least two Members, who certify that they personally know the nominee or candidate, and that he is worthy of acceptance. The proposal of Member, Associate or Junior shall contain a statement, over the candidate's signature, of his age, residence, the nature and term of his professional service, and that he will conform to the requirements of membership, if elected. Honorary Members, Corresponding Members and Fellows shall not be required to present themselves as candidates; those making the nomination shall state the grounds therefor, and certify that the nominee will accept if elected.

SECTION 25.—A proposal for transfer from one class to a higher shall be made by at least two Members, who state the age of the candidate, and the nature and term of his professional service since his admission to the Society. Such statement shall show a degree of qualification sufficient to render the proposed eligible to election in the class to which the transfer is asked. Upon approval of the Board of Direction, the candidate shall be balloted for, as provided in the election of members; and when the transfer is made, he shall not be required to pay an additional entrance fee.

SECTION 26.—A nomination or proposal shall be presented at the next regular meeting of the Board of Direction following its receipt; when it is thereby approved, and the applicant (if for admission as Member, Associate or Junior) classed with his consent, a day shall be fixed for the ballot to be canvassed, which shall be at a regular meeting of the Society, not less than thirty days thereafter.

SECTION 27.—When such day is fixed, the Secretary shall conspicuously post in the rooms of the Society the name and class of the nominee or applicant, his residence, occupation and the names of his proposers; he shall mail to each Member whose address is known, a notice of the same, with a letter-ballot in such form as shall be prescribed by the Board of Direction, and request the recipient to vote thereby or in person in the usual manner on the day fixed, when an open canvass of the votes cast shall be made, and the result announced.

SECTION 28.—The proposers of any rejected candidate may, within

three months after such rejection, lay before the Board of Direction written evidence that an error was then made, and ask for a reconsideration of the proposal, which shall be granted on sufficient grounds, and if a ballot has been taken, another shall be ordered.

SECTION 29.—(Proposed by Mr. Morse at the Annual Meeting, namely:) Persons who shall be elected members of this Society after six months of any fiscal year shall have expired, shall pay only one-half the amount of dues for that fiscal year, otherwise required.

SECTIONS 3, 4, 5, 6, 7, 8, 11, 12, 14, 16 and 19 are unchanged; Section 16 now being Section 21, and Section 19 now being Section 30.

Finally, the committee recommend the repeal of By-Laws conflicting with those here recommended, being Sections 1, 2, 9, 10, 13, 15, 17 and 18.

For the Committee,

GEORGE S. GREENE,  
Chairman.

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## MEMOIRS

APPENDED TO THE ANNUAL REPORT OF THE BOARD OF DIRECTION.

OF MEMBERS OF THE AMERICAN SOCIETY OF CIVIL ENGINEERS  
WHO DIED DURING THE YEAR 1872-3.

Presented November 5th, 1873.

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GEORGE M. DEXTER, C. E., of Boston, Mass.—Admitted to the Society December 3d, 1852, died November 26th, 1872. (No other particulars of Mr. Dexter's professional career are known to the Board of Direction.)

SAMUEL STEWART CHASE, C. E.—Died, May 29th, at his residence in Holyoke, Samuel Stewart Chase, aged 48 years.

His death, although unexpected, took place after a long confinement to his house, and was occasioned by an injury to his knee, which finally necessitated amputation, from the shock of which his system had not the strength to rally. He was born in 1825, at Dover, N. H., and at an early age removed with the family to Chicopee, Mass. Although receiving but a common school education, he was distinguished for mathematical taste and ability, and became a favorite of his uncle Mr. John Chase, then a very prominent practical hydraulic engineer. When Mr. John Chase was appointed Chief-Engineer of the Hadley Falls Water Power Co., at Holyoke, Mr. Philander Anderson became the Resident Engineer; Stewart Chase, as he was usually called, was his assistant, and at the death of Mr. Anderson became the Resident Engineer.

On the completion of the dam and the first sections of the canals at Holyoke, Mr. John Chase was appointed Chief-Engineer of the Water Power Works, at Fredericksburgh, Va., and sent Stewart there as Resident Engineer and superintendent, under whom these works were successfully carried through.

Returning from Fredericksburgh, Stewart took charge of the construction of the present dam and canals at Chicopee Falls, and of the dam and canals of the new Water Shops of the United States Government, at Springfield. With the transfer of the property of the old Hadley Falls Co. to the present Holyoke Water Power Co., he was recalled to Holyoke, as the agent and engineer, and at the time of his death was the treasurer of the company.

Considering the interests of his company and of the town identical, he devoted his entire time to the promotion and extension of its industries, and to the establishment of churches and public schools; thus contributing to all its permanent interests, the success of Holyoke has become assured.

To his essentially quiet disposition it was due that he was so little known outside of his friends and business associates. His convictions were strong as his engineering works; as an engineer he was a success; as the agent of a great corporation, he never betrayed his trust; as a husband, a father, a son and a brother, as a neighbor and a friend, in all these relations of life, he "acted well his part." What more can be said of any one, and of how few can this be said truthfully? He became a Member of the American Society of Civil Engineers, Dec. 8th, 1868, and a Fellow, March 12th, 1870; feeling a deep interest in its welfare, he was always ready, without display, to labor for its success, and in him was lost one of its most devoted members.

GEN. WILLIAM H. SIDELL, of the United States Army, died in New York, July 1st, 1873, after a long and painful illness, contracted in the service. Born on August 21st, 1810, he was sent to the Military Academy at the age of 19, and graduated in 1833, near the head in a class which numbered among its members, Gen. J. G. Barnard of the Engineer Corps, Gen. Shriver, Inspector General, the late Col. W. W. S. Bliss, Secretary to President Taylor, and many others who have since attained distinction either in military or civil life.

The duties of a line officer of infantry, to which Mr. Sidell was assigned on graduating, were too irksome and monotonous for his active mind, and he resigned at the end of a few months, to enter the more congenial profession of Civil Engineer. The railroad system of the country was then in its infancy, and he at once entered upon undertakings of the first magnitude. Among the roads with which he was professionally engaged were the Western, of Massachusetts, now merged in the Boston and Albany, the Erie, and the Panama. He was also employed on the Croton Aqueduct and the High Bridge, and in all these

enterprises showed such skill and ability, that he was subsequently employed by the United States in conducting the survey of the Mississippi river, and of the regions lying between that and the Rocky Mountains, with a view to ascertain a favorable route for a railroad to the Pacific. Soon after the outbreak of the war with Mexico, in 1846, he was appointed an officer of a regiment intended to be raised in this State for that service, but the speedy "conquering of a peace" rendered it superfluous, and it was never mustered in. He then turned his attention again to civil engineering, and was engaged on a number of the leading railroad lines in the Western States. He was one of the founders of the American Society of Civil Engineers, having become a Member, December 1st, 1852—the seventh on the record.

His life at the South had given him an insight into the spirit which, in 1861, culminated in open rebellion, and he was one of the earliest to offer his services to the government to aid in its suppression. On the enlargement of the regular army he received an appointment, and in May, 1861, was commissioned as Major of the 15th Infantry, and in the autumn of that year was assigned to duty as chief mustering officer in Kentucky, in the Department of the Cumberland, then commanded by Gen. W. T. Sherman. He continued in that service on the staffs of Gens. Sherman, Buell and Rosencrans, until the summer of 1863, when he was detailed as Acting Assistant-Provost Marshal General of Kentucky, under the enrollment Act of March, 1863. In addition to his duties as chief mustering officer of the department, he was, in 1862, assigned to duty as Assistant Adjutant-General at the headquarters of the Army of the Ohio, at Nashville, Tenn., which position he retained until transferred to Kentucky.

The duties of mustering officer, though less conspicuous than almost any other, are of the first importance, and some idea of the ability and success of his efforts may be gained from the fact that he planned and executed a system by which more than 200,000 soldiers were mustered into service, and, at the expiration of their terms, again mustered out without any confusion or delay, and with such completeness of record that the rolls show the exact military history of every one of that immense number. His services as Provost Marshal of Kentucky were no less useful, and were recognized by the government by conferring upon him the brevet rank of colonel and brigadier-general for distinguished and faithful service.

In May, 1864, he was commissioned lieutenant-colonel of the 10th Infantry, and at the close of the war he was assigned to duty at Fort Leavenworth, where, in 1870, he had a stroke of paralysis, which led, in December of that year, to his being placed on the retired list in that class of officers retired "for incapacity resulting from long and faithful service, from wounds or injuries received, from disease contracted, or from exposure in the line of duty." He returned to his home in this city, gradually

sinking away, under the severe shock which he had suffered, until his death.

Gen. Sidell had attractive personal qualities : brilliant in conversation, clear in the conception of whatever subject might interest him, ardent in his impulses and decided in his convictions, he never failed to impress himself strongly upon all with whom he was brought in contact. Not the least of his good services to the government was the stimulating sense of duty with which he inspired all officers coming within his sphere of action, and the industry and energy with which he performed every task imposed upon him.

SAMUEL BARRETT CUSHING, C. E., was born in Providence, R. I., February, 1811. At the age of sixteen he began the study of his profession, under Mr. Holmes Hutchinson, Chief Engineer of the Blackstone Canal, and remained upon that work until its completion. From 1830 to 1833 he practiced in Providence, during which time he ran out the boundary line between Rhode Island and Massachusetts, and made the principal surveys for a map of Rhode Island. About 1833 he removed to Illinois, where he remained until 1843, when, accepting an earnest invitation from prominent business men in Rhode Island to apportion the ownership of certain water-powers on the Blackstone river, he returned to Providence, and resided there until his death.

In connection with an extensive general practice, he built the granite bridge over the Blackstone river at Pawtucket, the railroad bridge at India Point, Providence, the railroad bridge over the Connecticut river at Lyme, and the Central bridge over the Seekonk river at Providence. Almost his last work was supervising the renewal of the drawbridge over Providence river at Point Street.

He was the inventor of a method of constructing bridge piers by placing timber piles within iron cylinders, the intervening spaces being filled with concrete ; a plan which has been successfully adopted in many cases, among which are the piers of the Tensas Railroad bridge, near Mobile, and the Shore Line Railroad bridge over the Connecticut, at Lyme.

As a hydraulic engineer, Mr. Cushing was among the first in his profession. His integrity of purpose and extensive experience in the management of water-power, caused him to be selected as arbitrator in important controversies involving the rights of owners.

On the morning of July 17th, 1873, he was found dead in his bed, having passed peacefully away ; his disease was an affection of the heart, from which he had long suffered.

He became a Member of this Society September 2d, 1869. His associates and friends, who mourn his loss from a profession he so well adorned, can point with pride to the record he made, as an earnest of what may be accomplished by a steadfast attention to duty, and an uncompromising adherence to truth.

## LIBRARY AND MUSEUM.

## ADDITIONS IN OCTOBER AND NOVEMBER, 1873.

At the Fourth Annual Convention, members of the Society connected with public works, or having facilities for obtaining reports and statistics of such, were earnestly requested to contribute copies to the Society. The great value in an engineer's library of any complete record in detail of work accomplished is evident, and efforts are being made to collect here full sets of government, municipal, railway, canal and other reports, and similar documents.

Members and others are asked to contribute regularly to the library of the Society copies of such reports, specifications, profiles, maps, photographs and other like matter, making up the record of engineering operations, and to inform the Secretary where such may be had. Duplicate copies are solicited also, for transmission to European Societies of engineers, in return for foreign reports collected and sent to this library by them.

## DONATIONS ARE ACKNOWLEDGED AS FOLLOWS:

From Theodore Allen, M. E., New York:

Illustrations of Stations on the "London, Brighton and South Coast Railway;" six large photographs:— and on the "London, Chatham and Dover Railway;" two large photographs.

A Working Model of "Silver's Governor for Marine Engines."

From D. Appleton & Co., New York:

The American Cyclopædia. Vol. 3. New York, 1873.

From A. S. Barnes & Co., New York:

Analytical Geometry. W. G. Peck, New York. 1873.

From L. F. Beckwith, C. E., New York:

Hydraulic Lime of Tiel and French Cements. New York, 1873.

From E. S. Chesbrough, C. E., Chicago, Ill.:

Twelfth Annual Report of the Board of Public Works of the City of Chicago. 1873. (Also copies for distribution.)

From Martin Coryell, C. E., Wilkesbarre, Pa.:

Reports on Canals, Railways, Roads, etc., made to Pennsylvania Society for Promotion of Internal Improvements. William Strickland. Philadelphia, 1826.

Portrait on steel of Canvass White, C. E.

Bridges across the Schuylkill, and at Newhope. By Louis Wernwag, C. E., Philadelphia, 1813: lithograph.

From Frederick H. Cruss, Esq., South Orange, N. J.:

Historical and Descriptive Account of the Suspension Bridge constructed over the Menai Strait in North Wales. With a brief notice of Conway Bridge. From designs by and under the direction of Thomas Telford. By W. A. Provis, Resident Engineer. London, 1828.



From Joseph P. Davis, C. E., Boston, Mass.:

Report of the Cochituate Water Board, April 30th, 1873. Boston.

From Gen. A. S. Dyer, Chief of Ordnance U. S. A. Washington, D. C.  
Ordnance Memoranda, No. 16. Report of the Board Convened at  
New York, January 16, 1873, to Report upon Carriages for Heavy  
Ordnance. Washington, 1873.

From C. G. Forshay, C. E., New Orleans, La.:

The Delta of the Mississippi. C. G. Forshay. 1873.

From J. M. Goodwin, C. E., Cleveland, Ohio.:

Atlantic and Great Western Railway: Gradients of Main Line and  
Branches: lithograph.

From Charles Hermans, C. E., Louisville, Ky.:

Louisville Water Company: Report for the year ending December  
31st, 1872. (2 copies.)

Report of Select Committee on Water Works; Cincinnati Investiga-  
tion, March, 1873.

From James Laurie, C. E., Hartford, Conn.:

Description of the Iron Bridge over the Connecticut River, on the  
Hartford and New Haven R. R. Theodore G. Ellis, C. E.

Senate, No. 283. Commonwealth of Massachusetts. Reports on the  
Hoosac Tunnel, May, 1871.

Fourth Annual Report of the Board of Railroad Commissioners,  
January, 1873. Boston.

Report of the General Railroad Commissioners, State of Connecticut.  
1873.

From F. C. Lowthorp, C. E., Trenton, N. J.:

Views of Lowthorp's Iron Draw-bridge on the New York, New Haven  
and Hartford R. R., across the Housatonic River. Three large  
photographs, framed.

From E. Maléziéux, C. E., Paris:

Catalogue Libraire des Corps des Ponts et Chaussées et des Mines,  
Architecture, Mécanique, Chimie, Enseignement Scientifique,  
Ponts et Chaussées, Mines, Telegraphs, Chemins de Fer, Naviga-  
tion. Paris, 1871.

Catalogue des Livres Composant la Bibliothèque de l'École des Ponts  
et Chaussées. Paris, 1872.

Exposition Universelle et 1873. France. Notices sur les Dessins,  
Modèles, et Ouvrages: réunis par les Soins du Ministère des  
Travaux Publics. Paris, 1873.

Exposition Universelle à Vienne en 1873. Étude Historique et  
Statistique sur les Voies de Communication de la France—d'après  
les Documents Officiels par M. Félix Lucas. Paris, 1873.

Travaux Publics des États-Unis d'Amérique en 1870. Rapport de Mis-  
sion par M. Maléziéux, Ingénieur-en-chef, Professeur de l'École  
Nationale des Ponts et Chaussées. Publié par ordre de M. le Mi-  
nistre des Travaux Publics. Texte et Atlas. Paris, 1873. 2 vols.

- Annales des Ponts et Chaussées. Mémoires et Documents relatifs à l'Art de Constructions, et au Service de l'Ingénieur : Lois, Décrets, Arrêtes et Autres Actes concernant l'Administration des Ponts et Chaussées. Cinquieme Serie. 1871, '2, '3. 13 volumes.
- From R. C. Morris, C. E., Nashville, Tenn. :  
 Twenty-first Annual Report of the Nashville & Chattanooga R. R. Co. 1871-2.  
 Annual Report of the Nashville & Chattanooga R. R. Co., August 13, 1873.
- From Charles H. Myers, C. E., New York :  
 Annual Reports of the Croton Aqueduct Department of the City of New York, for 1852, 1859, 1861 to 1869. 11 volumes. (Also duplicate copies.)
- From Ernest Pontzen, C. E., Vienna:  
 Urber die Wasserabrahame in den Quellen Flüssen und Stromen bei gleichzeitiger Steigerung der Hochwässer in den Culturländern. Von Gustav Wex. Wien, 1873.
- From Prof. G. W. Plympton, Brooklyn, N. Y. :  
 Theory of Gunnery. Projectiles. Gen. P. Anstruther. 1871.
- From Rear-Admiral B. F. Sands, U. S. N., Washington, D. C. :  
 Catalogue of Stars observed at the U. S. Naval Observatory during years 1845-1871. Prof. M. Yarnall, U. S. N. 1873.
- From G. Soldan, Esq., New York:  
 Axle Box for Passenger Cars ; Journal Box for Shafting. Two lithographs.
- From C. P. Sandberg, C. E., London :  
 Safety of Permanent Way, with Tables concerning Punching and Notching of Rails. C. P. Sandberg. London, 1873. (Also copies for distribution.)
- From T. Guilford Smith, C. E., Buffalo, N. Y. :  
 Reports of the Secretary of War. Washington, 1866-1872. 11 vols.
- From Prof. R. H. Thurston, Hoboken, N. J. :  
 On the Molecular Changes Produced in Iron by Variations of Temperature. Philadelphia, 1873. (Also copies for distribution.)
- From E. B. White, C. E., New York:  
 Sections of R. R. Ties, showing the Curvo Spike in place ; samples of the Spike.
- From C. Williams, Esq., New York :  
 The Williams Rapid Transit Viaduct or Suspended Trackway for Rapid Transit Railways. New York, 1873.
- From W. E. Worthen, C. E., New York :  
 Bridge at Dixon, Ill., after the accident. Photograph.
- The following were purchased :—  
 Specifications and Drawings of Patents issued from the United States Patent Office for May and June, 1873. Washington. 2 volumes.

## NOTES AND QUERIES.

NOTE.—It is proposed to include under this head, questions and replies relating to the theory and practice of engineering. Members are urged to contribute to this department.

Q. 3. Where was the term "chord" first used in print, as referring to the horizontal members of a bridge or truss?

Q. 4. In this climate, and under the various circumstances usually met with in practice, what proportion of the rain fall on given areas of water sheds is available for use by storage—and what are the reasons for the estimates which may be given?

Q. 5. What have been the methods and results of experiments, to determine the evaporation of water stored in reservoirs in the Eastern and Middle States?

Q. 6. What in detail, is the cost per mile, of laying on paved streets a single track "horse" railroad, and of its equipment?

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 ANNOUNCEMENTS.

A LIST OF NEW ENGINEERING AND TECHNICAL BOOKS—English, French and German—and brief examinations of the more important, by members familiar with the subjects treated, will be published in the January number of "Transactions," and regularly afterward.

TOPICS FOR CONSIDERATION, at future meetings of the Society, will be announced in time to permit non-residents to take part, either in person, or by communicating with the Secretary, and attention is called to those herein set down for meetings in January and February. Members are requested to give early notice when, and upon what subjects they will contribute papers, and those seeking information are asked to suggest professional topics for discussion.

COMMENTS AND DISCUSSIONS, on papers herein published, are solicited. It is hoped that each member, whether present at meetings of the Society or not, will communicate for publication what his experience teaches of the subjects considered.

PHOTOGRAPHS OF MEMBERS.—At a meeting held October 20th, 1869, the Society resolved that each member be requested to furnish two photographs of himself, of the usual carte de visite size, as a means of promoting social recognition and intercourse. This has been done by so many members, that those who have not, are specially asked to help make the collection complete, by speedily forwarding their photographs, endorsed with autograph and date.

**MEETINGS.**—The next evening meeting of the Society will be held Wednesday, December 17th, at 8 o'clock P.M., at which a paper describing a "Plan adopted for raising a draw-span after the false-works were carried away," by C. S. Maurice, C. E., of New York, and a "Note relative to the accuracy and value of Rumford's determination of the mechanical equivalent of heat," by Prof. R. H. Thurston, of Hoboken, N. J., will be read and discussed.

The next regular meeting of the Board of Direction will be held Monday, January 5th, at 2 o'clock P.M.

The next afternoon meeting of the Society will be held Wednesday, January 7th, at 1 o'clock P.M., when ballots for members will be canvassed; the recommendation of the Board of Direction fixing the fees and dues of Juniors, and the amended By-laws, reported to the Society December 3d last, will be called up for approval; and a "Description of the alignment of Hoosac Tunnel" will be given.

At the evening meeting of the Society to be held Wednesday, January 21st, "Tests of materials used in construction, and testing machines" will be considered; reference is made to the Report of the Committee on "Tests of American iron and steel," and the remarks offered at the meeting held November 17th last, herewith published; members having information upon the subject are requested to present it; full descriptions of testing machines in use are specially asked for.

At the evening meeting of the Society to be held Wednesday, February 18th, an examination into "The elements of cost of railroad traffic" will be made, with a view to determine the same under their appropriate heads, and to discover wherein, and in what manner, a reduction may be effected. The discussion upon LXII Transactions, herewith published, bears upon this subject, which it is hoped railroad managers and others interested will take up and continue. Details of the several items of cost of railroad traffic, as given in reports or otherwise, and references to where such may be found, are desired.

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#### ADMISSIONS TO THE SOCIETY.

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Nov. 5th, 1873.	ALDRICH, JAMES C.	New York.
Nov. 1st,	" FUNIAK, FREDERICK DE	Louisville, Ky.
Dec. 9th,	" GRANT, WILLIAM H.	New York.
Nov. 21st,	" HOE, RICHARD M.	"
" 6th,	" KIMBERLY, MOSES C.	Brainard, Min.
Oct. 31st,	" LATCHA, JACOB A.	Toledo, Ohio.
" 23d,	" MCCREA, JAMES.	Hollidaysburgh, Pa.
Nov. 24th,	" SMITH, ISAAC W.	Olympia, W. T.
" 21st,	" TUCKER, STEPHEN D.	New York.

# AMERICAN SOCIETY OF CIVIL ENGINEERS.

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## PROCEEDINGS.

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### MINUTES OF MEETINGS.

(Abstract of such as may be of general interest to members.)

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#### OF THE SOCIETY.

DECEMBER 17TH, 1873—A stated meeting was held at 8 o'clock P. M.

C. S. Maurice, C. E., of Athens, Pa., read a paper describing a "Plan Adopted for Erecting a Draw-span without False-works," and a discussion followed.

A communication from James H. Post, Lost-baggage Agent, Erie Railway, giving account, substantially as follows, of the introduction of baggage checks, by Simeon S. Post, C. E., late Member of the Society, was read. During the winter of 1848-9, while Mr. Post was Superintendent of the New York and Erie R. R., by his direction, small tin checks with numbers stamped on them (the first that were used) were attached to baggage, then brass checks bearing numbers and the initials of the corporation; and lastly was adopted his full plan of local checks as now used upon this line. These were brass and copper checks stamped with the names of stations, and numbered, each division of the road had a special shape for checks of stations within its limits. He intended that for important places brass checks, and for the others copper checks should be used. It was suggested that a train baggage master enter in a book the numbers of the checks on the baggage he carried, and mark them off when the baggage was delivered; a plan which Mr. Post afterwards adopted for the whole line.

The following topics were then taken up: "The setting of cement under pressure in Pneumatic Foundations;" "The cost of driving piles with the Gunpowder Pile-Driver, and the force of its blow."

JANUARY 7TH, 1874—A regular meeting was held at 1½ o'clock P. M. ballots upon application for admission to membership were canvassed, and Edward Hemberle, C. E. of Chicago, Ill., Henry Pettit, C. E. of Philadelphia, Pa. and Robert C. Morris, C. E. of Nashville, Tenn., were declared elected Members. The resignations of J. C. Cheshbrough, C. E. of Albany, N. Y. on October 22d, and of R. Escobar, C. E. of New York on December 17th last, Members, were announced.

The following recommendations, presented at the meeting held December 3d\* last, were adopted: of the Board of Direction, "that for a Junior, during the year 1873-4, the entrance fee shall be \$20, and the annual assessment \$10;" and of the committee appointed to revise the By-Laws of the Society, that the By-Laws thereby reported† for repeal be repealed, and the By-Laws for adoption be adopted.

It was made a rule that members, to be entitled to extra copies of any paper which they may contribute, must give notice to the Committee on Library, before such paper is printed, of the number required.‡

Charles Macdonald, C. E., of New York, gave a verbal "Description of the Alignments of the Hoosac Tunnel."

#### OF THE BOARD OF DIRECTION.

JANUARY 5TH, 1874—A regular meeting was held at 2 o'clock P. M.; proposals for admission to the Society were considered. Under Article XXXI of the Constitution, it was declared that the following had ceased to be members: Messrs. Francis E. Appleton, William G. Atkinson, F. W. Bacon, A. J. Centre, Charles J. Everett, William Fenton, Thomas Fuller, John McNamee, T. A. Mysenberg, James T. Munn, Augustus Laver, John I. Shipman, Egbert L. Viele and James A. Whitney.

Reports were presented from the Committee on Norman Medal, which were accepted, and set down for special consideration at the meeting of the Board to be held February 4th—and from the Committee on Library, comprising "a list of subjects relating to the practice of engineering," which was adopted.

A communication was read from the President of the Engineers' and Architects' Association of Austria, proposing an exchange of publications, and inviting members of this Society to visit the rooms of the Association, in Vienna; the Secretary was instructed to acknowledge and accept the proffered courtesies.

It was determined to appoint a committee of five, or less, senior members of the Society, in each state and foreign country, where such may reside, to procure regularly, for the library reports and other descriptive matter published for distribution, relating to engineering work. The Secretary was directed to send a circular to the President, Treasurer and Chief Engineer of each railroad, and the same or similar officials of each other public, municipal, state and federal work in the United States and Canada asking for past reports and future issues as published, calling attention to the Society, and stating its nature and purpose.

The stated meetings of the Board were changed from the first Monday—to the Monday preceding the first Wednesday—in each month.

\* Proceedings, page 34. † Ibid, page 36. ‡ Under resolution of the Society, passed April 6th, 1870, authors are entitled to 25 copies of papers contributed by them.

## REPORT OF THE COMMITTEE ON LIBRARY,

COMPRISING A LIST OF SUBJECTS RELATING TO THE PRACTICE OF  
ENGINEERING, ADOPTED JANUARY 5TH, 1874.

In response to a resolution of the Board of Direction, passed December 1st, 1873, requesting the Committee on Library to prepare a list of subjects relating to the practice of engineering, its connection with kindred arts and public affairs, on which papers should be solicited, said Committee beg leave to report the following list, and recommend that it be published in the Transactions, with a request to members that they prepare papers upon such as may be within their several experiences, and give early notice of their intention so to do.

CHARLES MACDONALD  
Chairman Committee on Library.

### PAPERS ARE SOLICITED :

- 1.—On the relation of railroads to the public as represented by the state.
- 2.—On the present development of railroad construction in America with the relation to the requirements of population.
- 3.—On the cost under various circumstances of transporting different classes of freight on railroads, with suggestions as to possible means of lessening the same.
- 4.—On the cost of transporting passengers by rail ; distinguishing between through, local, and suburban traffic.
- 5.—On the delivery, storage, and distribution of freight in large cities.
- 6.—On the relative merits of the two methods of supplying meats to large cities, viz., by transportation of animals on the hoof or after slaughtering.
- 7.—On rapid transit for passengers in large cities.
- 8.—On the relative economy of water and rail transportation from the West to the seaboard, together with the introduction of steam as a motive power on canals.
- 9.—On cost of transportation of coal to market, as affected by grades on existing lines.
- 10.—On the relative economy of the several kinds of fuel used for purposes of transportation.
- 11.—On the manufacture, testing and wear of iron and steel rails, and relation of rail section to weight of rolling stock.
- 12.—On the different appliances used for rail joints ; the extent of their application and relative economic value.
- 13.—On traction engines.



14.—On recent progress in America in the construction of bridges in iron and steel.

15.—Giving detailed descriptions of any work in civil or military engineering as far as executed. Reports upon the St. Louis and East river bridges as examples.

16.—On the determination of strains in pivot bridges and turntables.

17.—On general specifications for bridge construction, classification, loading, and factors of safety.

18.—On the relation of railroad bridges to inland navigation.

19.—On American irons, enumeration of number and extent of districts of supply, with general characteristics of each, and brief notices of undeveloped iron deposits.

20.—On the manufacture of iron and steel in America, with description of the latest improvements in machinery, including mechanical puddling and the application of hydraulic power.

21.—On testing machines.

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- From Samuel Keefer, C. E. Brockville, Canada: Reports of the Commissioners and the Chief Engineer on the Welland Canal Enlargement. Ottawa, 1873.
- From David Kirkaldy, Esq., London: Experimental Enquiry into the Mechanical Properties of Fagersta Steel. London, 1873.
- From James O. Morse, C. E., New York: Journal of the Franklin Institute, 1828-1865. Philadelphia. 38 vols.
- From Thomas Prosser, Esq., New York: Cast-steel Works of Fred Krupp. Essen, Rhenish Prussia.
- Framed Photograph of same, 1873.
- From William Sellers & Co., Philadelphia: Treatise on Machine Tools—illustrated with Photographs. Philadelphia, 1873.
- From William E. Worthen, C. E., New York: Reports of the Geological Survey of Indiana, made in 1869 '70, and '72, by E. I. Cox, with maps. Indianapolis. 5 vols.
- Report of a Geological Survey of Wisconsin, Iowa and Minnesota, and a portion of Nebraska Territory, by D. D. Owen. Philadelphia, 1852.



## ANNOUNCEMENTS.

## THE NEXT EVENING MEETING

of the Society will be held Wednesday, January 21st, at eight o'clock p. m., "Tests of Materials used in Construction and Testing Machines" will be considered. That discussion thereon at this or a succeeding meeting may, in degree at least, be profitable and exhaustive, information is desired as specified below, or otherwise referring to this subject.

1st. Unpublished records of tests of any materials; or if published, those which are not generally accessible.

2d. Full descriptions of testing machines, including pressure gauges, with drawings or tracings if possible (to be returned upon request).

3d. Suggestions on methods of testing specimens in pieces, of the shape and size and under the conditions of actual use, to determine the maximum safe load for such shape and the best distribution of material in any piece to sustain a given load.

4th. Facts or suggestions referring to the effects of time, vibration, shock, changes of temperature and methods of fabrication, upon the strength of materials in use.

5th. Reference to published statements of what has been attempted or effected by foreign governments, or individuals, relating to this general subject.

The next stated meeting of the Board of Direction will be held on Monday, February 2d, at 2 o'clock p. m., at which reports of the Committee on Norman Medal will be specially considered.

The next afternoon meeting of the Society will be held on Wednesday, February 4th, at 1 o'clock p. m.

At the evening meeting of the Society to be held Wednesday, February 18th, an examination into "The elements of cost of railroad traffic" will be made with a view to determine the same under their appropriate heads, and to discover wherein and in what manner a reduction may be effected. The discussion upon No. LXII Transactions bears upon this subject, which it is hoped railroad managers and others interested will take up and continue. Details of the several items of actual cost of railroad traffic, as given in reports or otherwise, or references to where the same may be found, are desired, especially under the following heads suggested in connection with this subject. It is hardly expected that any memoranda furnished will cover more than a few points—rough notes or statistics referring to but a single point will be of value,

## PASSENGER TRAFFIC.

1st. What are the various elements of the cost of passenger traffic, distinguishing, if possible, between through, local and suburban business?

2d. What are the usual or the possible proportions between the numbers of seats carried and passengers transported one mile, on various lines?

3d. What are the weights of passenger cars per seat carried, and what is the proportion of dead weight of passenger trains, per seat and per passenger transported, on various lines?

4th. To what extent is the cost increased to paying passengers, by the practice of giving complimentary passes, and by paying commissions upon tickets sold?

5th. In what manner, and to what extent, is the cost of passenger traffic affected by gradients and by curves?

6th. How is it possible to secure greater economy in the transportation of passengers, without materially reducing the accommodation demanded by the public?

## FREIGHT TRAFFIC.

1st. What are the several elements of the cost of transporting freight, distinguishing between those which increase in proportion with the traffic, and those which are arbitrary or nearly so?

2d. What are the circumstances of location, construction or traffic, which cause a greater cost of transporting freight per ton per mile on one road than upon another?

3d. What is the difference of cost of each of the various classes of freight, as generally divided in freight traffic?

4th. What principles are generally adopted, or should govern, in making up freight traffic?

5th. What are the proportions of dead weight and paying loads on various lines, and to what extent do they affect the aggregate cost?

6th. In what manner, and to what extent, is the cost of transporting freight influenced by the grades, curves or peculiarities of construction?

COMMENTS AND DISCUSSIONS.—On the papers published in Transactions, are solicited from members, whether present at meetings of the Society or not. They are urged to contribute selections from their note-books, and other similar recorded experience bearing upon the subjects considered; those seeking information are asked to suggest professional topics for discussion.



# AMERICAN SOCIETY OF CIVIL ENGINEERS.

## PROCEEDINGS.

### MINUTES OF MEETINGS.

(Abstract of such as may be of general interest to members.)

#### OF THE SOCIETY.

JANUARY 21ST, 1874.—A stated meeting was held at 8 o'clock P. M.

The subject for consideration, "Tests of Materials used in Construction and Testing Machines," was announced. Communications, and the following papers in response to the circular\* sent out, inviting discussion, were presented: "Experiments on the Tensile Strength of Bar Iron and Boiler Plate," by Charles B. Richards, M. E.; "Proportions of the Heads of Eye Bars," by Charles Macdonald, C. E.; "Tests of Wrought-Iron Beams and Rods," by T. Guilford Smith, C. E.; "Tests of Bridge Irons," by Gen. W. Sooy Smith; "Effects of Cold on Iron and Steel Rails," by A. D. Briggs, Esq., and "Experiments on Steel Wire," by Thomas C. Clarke, C. E.

The papers, "Experiments on the Tensile Strength of Bar Iron and Boiler Plate," "Proportions of the Heads of Eye Bars,"† and "Tests of Bridge Irons," were read and discussed.

Descriptions of the hydraulic weighing apparatus of Mr. Albert H. Emery, and of various testing machines in use were given, after which, enquiry was made into what should be sought for in testing materials.

Further consideration of the subject was postponed to the meetings to be held February 4th and March 18th.

FEBRUARY 4TH, 1874.—A regular meeting was held at 1½ o'clock P.M.

A communication from Hon. William J. McAlpine, affirming the propriety of engineers making charge, the same as other professional men, for advice given, and one from Prof. Estevan A. Fuertes, asking the Society to declare what should be the course of instruction in schools and colleges, for students of engineering, were read. The latter was referred for consideration and report to a committee, consisting of Prof. De Volson Wood, Mr. Charles Macdonald and Prof. George W. Plympton.

Prof. Robert H. Thurston read a paper entitled "Researches on the

\* Published on page 58.

† The first two of these papers, with discussions, are published herewith.

Resistance and the Physical Properties of Materials," illustrated by his machine for making graphic tests of the torsional strength of materials; which, with its manner of working, was exhibited, and samples of tests made were shown. Consideration of this paper was deferred to the regular meeting to be held on April 4th, and by vote Prof. Thurston was thanked for the clear, novel and able presentation of the subject made.

#### OF THE BOARD OF DIRECTION.

FEBRUARY 2D, 1874.—A stated meeting was held at 2¼ o'clock P. M.; proposals for admission to the Society were considered.

The reports of the Committee on Norman Medal, accepted by the Board, January 5th, were taken up. The Chairman of the Committee, by invitation of the Board, attended and took part in the proceedings. A "Code of Rules to govern Competition for the Norman Medal" was presented, and after discussion, further consideration of the subject was postponed to the meeting of the Board to be held March 2d.

#### BOOK NOTES.

##### PROCEEDINGS OF ENGINEERING ASSOCIATIONS IN GREAT BRITAIN.

OF THE INSTITUTION OF CIVIL ENGINEERS.\*—The "Minutes of Proceedings" of this Institution, published in 1873, refer to the meetings held from November 12th, 1872, to May 27th, 1873, and contain the following papers, with abstracts of discussions thereon:

"The Aba-e Wakf sugar factory, Upper Egypt," by William Anderson; "The practice and results of irrigation in Northern India," by W. H. Greathed; "Cylindrical or columnar foundations in concrete, brick-work and stone-work," by John Milroy; "The relative advantages of the 5½ feet gauge, and of the metre gauge for the state railways of India, and particularly for those of the Punjab," by William T. Thornton; "The Mount Ceniz tunnel," by Thomas Sopwith, Jr.; "The rise and progress of steam locomotion on common roads," by John Head; "The Riga railway," by William Pole; "The river Clyde," by James Deas, and "The changes that have recently taken place along the sea coast of the delta of the Danube, and on the consolidation of the provisional works at the Sulina mouth," by Sir Charles A. Hartley.

It may be noted that the discussions on these papers for each, occupied from one to seven evenings—and take up, in the published proceedings, from 6 to 307 pages, while the longest paper takes but 48 pages.

There are also memoirs of 26 members—a catalogue of additions to

\* Minutes of Proceedings of the Institution of Civil Engineers, with abstracts of the Discussions, Vols. XXXV, XXXVI, Session 1872-3. London, 1873.

the library, and the annual reports and statements for the year ending November 30th, 1872. From the latter, it appears that there were 16 honorary members, 752 members, and 1,115 associates, the receipts were £8,279 17s. 5d., expenses £8,880 16s. 5d., and the amount of funds £28,654 69s. 11d.; also, thirteen premiums were awarded to authors of papers presented.

OF THE INSTITUTION OF ENGINEERS AND SHIPBUILDERS OF SCOTLAND.\*

—The "Transactions" of this Institution, published in 1873, contains the "Minutes of Proceedings" at the meetings held from October 22d, 1872, to April 22d, 1873, the President's annual address, the yearly reports and statements, a list of members and of additions to the library, and the following papers, with discussions thereon:

"Improved canting crowned anchors," by Captain Thompson; "A new form of equilibrium water sluice or stop valves," by F. G. M. Stoney; "Mineral oil as a lubricant," by J. J. Coleman; "Street tramways," by John Page; "Mining machinery," by George Simpson; "Improvements in the construction and working of swing bridges and the gates of dock and canal locks, &c.," by David Cunningham; "An automatic steering apparatus," by M. A. Siciliano; "Signalling through submarine cables," and "The rope dynamometer, with application to deep sea soundings by steel wire," by Sir William Thompson; "A proposed steamer for channel service," by James Lyall, and "The manufacture of cast-steel," by B. D. Healey.

OF THE INSTITUTION OF MECHANICAL ENGINEERS.†—The publication issued contains papers as follows:

"On the mining district of Cornwall and West Devon," by J. Henry Collins; illustrating the lithology of the country, position of veins and modes of working, by 15 plans and sections, and treating of the duty of Cornish engines, the cost of sinking and drifting shafts and levels, and of crushing and washing iron ores, the quantities and values of tin, copper, lead and iron ores, china clay and stone; "On the mechanical appliances used for dressing tin and copper ores in Cornwall," by Henry T. Ferguson; illustrated by 22 plates of stamping, crushing, pulverising, buddling, calcining and sluice machines, with a very clear description of them, and a discussion on their values; and a "Description of the tin stream works in Restronguet creek, near Truro," by Charles D. Taylor; with plan and section, describing the working of this mine under about 70 feet of mud and water, also the sinking of a cast-iron cylindrical shaft, 6 feet in diameter, through the mud by direct pressure. There is incidental to a trip to the last-mentioned mine, a description of the mode of turning granite columns, &c., at Penryn.

\* Transactions of the Institution of Engineers and Shipbuilders of Scotland, Vol. XVI. Sixteenth Session, 1872-3. Glasgow, 1873.

† Institution of Mechanical Engineers. Proceedings 29th and 30th July, 1873, Cornwall meeting. Part I. Birmingham, 1873.

REPORT OF THE CHIEF OF ENGINEERS, U. S. A. FOR 1873.\*—This is a report upon the duties and operations of the Engineer Department for the year ending June 30th last, and in addition to the matter usual in official communications of this character, includes much of general interest to the profession at large.

It contains tables of the water levels of the western lakes; plans for the improvement of lake and seaboard harbors, and of river navigation; details of the construction of snag boats, break-waters, dams, and ship canals; reports on the bridging of navigable streams, removal of bars, and wrecks, deepening of channels, submarine rock drilling, blasting and excavating—a history of the Red river raft—accounts of explorations in the territories, and other similar valuable matter.

TABLES AND FORMULÆ.†—A third edition of a work compiled in 1849, for the use of the Corps of Topographical Engineers, with such additions and corrections as experience has suggested and the requirements of the service seemed to demand, has recently been published. Intended especially for field use by officers engaged in surveys or explorations, it will be found of value to others similarly employed.

In the revision, the paper of Major Abbot, Corps of Engineers, on the practical gauging of rivers, contained in the Proceedings of the Essayon's Club, was followed; the article on trigonometrical leveling was taken principally from Appendix No. 7, Coast Survey Report for 1868; and Appendices Nos. 9, 10 and 11 of Report of same for 1866, were referred to, in writing the pages relating to the use of the transit instrument, the zenith telescope and to the determination of astronomical azimuths. The tables for the barometric measurements of heights were condensed from those in Col. Williamson's "Treatise on the use of the barometer," Professional Papers Corps of Engineers, No. 15. The article on longitude by lunar culminations was prepared by Prof. Bartlett, of the U. S. Military Academy; and one on "Magnetic field observations," having for their object the determination of the magnetic declination, dip and intensity at any given time and place, was contributed by Capt. Raymond, Corps of Engineers.

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#### NOTES AND QUERIES.

Q. 7. What is the pressure per square foot at which settlement of a foundation will occur, on fine sand, whose natural slope is  $2\frac{1}{2}$  or 3 to 1, and what is the safe load on such at a depth of 5 or 6 feet below the surface?

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\* Annual Report of the Chief Engineer to the Secretary of War, for the year 1873. Washington.

† No. 12. Professional Papers of the Corps of Engineers of the United States Army. Published by authority of the Secretary of War. Tables and Formulas useful in Surveying, Geodesy and Practical Astronomy, including Elements for the Projection of Maps, and Instructions for Magnetic Observations. 3d edition, revised and enlarged. Washington, 1873.

## NEW BOOKS ON

## ENGINEERING AND TECHNOLOGY.

Under this head will be announced new books on these and kindred subjects in English, French and German, which may be professionally useful to members of the Society.

At the present rates of duty and exchange, the cost of imported books may be estimated in federal money, taking one shilling equal to 50 cents, and one franc to 37 cents.

- Architecture, History of the Modern Style of—James Ferguson, D. C. L. 2d. ed. London. 8vo, illus. \$12.00.
- Armed Strength of Austria—Compiled at the Topographical and Statistical Department of the War Office. By Capt. W. S. Cooke. London. 8vo. \$5.25.
- Army. First Report of the Director-General of Military Education, on the Education of Officers. (Regulations, Examinations, Course of Instruction at Sandhurst, Staff College, Woolwich, Royal Military Academy, &c.) London. 8vo. 7d.
- Artillery Exercises, A Manual of—8vo. 5s.
- Attraction. A History of the Mathematical Theories of Attraction and the Figure of the Earth, from the Time of Newton to that of Laplace. J. Todhunter. London. 2 vols. 8vo. 24s.
- Breech-Loaders. George E. Woodward. New York. Large 12mo. \$2.00.
- Bridges and Highways. Course on—as taught at the "Ecole Centrale" of Arts and Manufactures. M. Mary. Paris (French). Text, 4to, atlas folio. \$18.00.
- Descriptive Catalogue of the Models, Instruments and Drawings of the National School of—H. Baron. (French.)
- Metallic. Calculation and Construction of—M. Laissle and Ad. Schuebler. Paris (French). 2 vol. 8vo. \$8.00.
- Boilers, Steam. Studies on Marine Steam Boilers. C. Ardenet. Paris (French). 8vo. \$0.80.
- Building Construction—showing the Employment of Brick, Stone and Slate in the Practical Construction of Buildings. By R. Scott Barn. London. 12mo. \$3.75.
- Builder's Pocket-book of Prices and Memoranda. Edited by William Young, architect. London. Royal 32mo. \$1.50.
- Carpentry. Album of Timber Frames. Achilles Logan. Paris (French). 4to, plates. \$10.00.
- Charcoal Burning and the Use of Combustibles in the Metallurgy of Iron. A. Gillot. Paris (French). 8vo. \$5.60.
- Carbonization of Wood in Closed Vessels, and Utilization of the Resulting Products. Camille Vincent. Paris (French). 8vo, illus. \$2.00.
- Chemistry. New Treatise on Industrial Chemistry for the use of Chemists, Engineers, &c. Prof. R. Wagner. French ed. from the 8th German. Paris (French). 2 vols. 8vo. \$8.00.
- Quantitative Chemical Analysis. Dr. C. Remigius Fresenius. 6th ed., reprinted from 4th. Translated from the 5th German ed. by A. Vacher. London. 8vo. \$7.50.
- The New Chemistry. Josiah P. Cooke, Jr., Prof. of Chemistry and Mineralogy, Harvard University. New York. 12mo. \$2.00.
- Cloth, Manufacture of—Treatise on the Manipulation of Carded Alpaca, Cashmere, Goats' and other wools. M. Alcan. Paris (French). 8vo, text. 4to, plates. \$16.00.
- Compass, Variations of—Ernest Fournier. Paris (French). 8vo. \$2.40.
- Curves, A Treatise on the Higher Plane Curves. Intended as a Sequel to Treatise on Conic Sections. 2d ed. George Salmon. Dublin. 8vo. 12s.
- Tables for Setting out Curves for Railways, Canals and Roads, varying from a Radius of 5 chains to 3 miles. London. 18mo. 2s. 6d.
- Cyclopædia, The American. A popular Dictionary of General Knowledge, edited by George Ripley and Charles Dana. Vol. IV. Carmora—Coddington. New York. 8vo. \$5.00.
- Dictionary—Industrial Dictionary for universal Use, or 100,000 Secrets and Receipts of Modern Industry, comprising Arts and Manufactures, Mines, Agriculture, &c. Vol. I. Aba. to Deg. (French). 8vo. 5 fr.
- Distillation, Recent Progress in. Desire Saville. Paris (French). 8vo, illus. \$4.80.
- Electricity, Exhibit of the Application of—Vol. 2d. Electric Technology. Count H. du Moncel. Paris (French). 8vo, illus. \$5.00.
- Engineering, Spon's Dictionary of—Civil, Mechanical, Military and Naval. With Technical Terms in French, German, Italian and Spanish. Ed. by Oliver Byrne. Division 7. London. 8vo. 13s. 6d.
- Engineer's Guide to the Local Marine Board Examinations. D. Thomson, M.A. With a Short Treatise on the Compound Engine, by John Turnbull, Jr. London. 12mo, illus. \$3.00.
- Millwrights' and Machinists' Practical Assistant. 5th ed. W. Templeton. London. 18mo. 2s. 6d.
- U. S. A. Annual Report of the Chief of Engineers to the Secretary of War for the year 1873. Washington. 8vo.
- Framed Structures. Economies of Construction in relation to—Robert H. Bow, C. E. London. 8vo. \$2.00.
- Geological Survey of Ohio, Report of—Vol. I.—Geology and Mineralogy. Part 1—Geology; Part 2—Paleontology. Columbus. 2 vols., royal 8vo. and atlas. \$10.00.
- Gunpowder, Theory of the Effects of—in Mines and Artillery. E. A. Brailion. Paris (French). 8vo. \$2.40.
- Guns and Steel. Miscellaneous Papers on Practical Subjects. Sir Joseph Whitworth. London. Royal 8vo, illus. \$3.75.
- Hydraulics, Molecular Forces in Liquids in Motion, with Applications to Hydro-Dynamics. M. Kleitz. Paris (French). 4to. \$8.00.
- Practical—A Series of Rules and Tables for the Use of Engineers. Thomas Box. 3d ed. London. 8vo. 5s.
- Various Devices for Raising Water, by Chavueau des Roches. Belau and Vigneux (French). 8vo, illus. 10s.
- Iron Trades, Guide to—of Great Britain. S. Griffiths. London. 8vo. 21s.
- Lightning, A Study on—Paul Perrin. Paris (French). 12mo, illus. \$1.00.

- Light, Polarized. A Lecture Delivered in the Hulme Town Hall, Manchester, Oct. 28, 1873. W. Spottiswoode. Manchester. 1d.
- Six Lectures on—Delivered in America in 1872-3. John Tyndal. London. 8vo. 7s. 6d.
- Locomotives. Report of Committee on Locomotives on Roads, with Evidence and Index. Parliamentary Report. London. 2 vols. 2s. 8d.
- Mapping and Surveying, Treatise on. J. Duplessis (French). 8vo. 4fr.
- Mathematics, A Treatise on—as applied to the Constructive Arts. F. Campin. London. 12mo. 7s. 6d.
- Mechanical Engineers. Institution of—Proceedings 29th and 30th July, 1873, Cornwall Meeting. Part I. Birmingham. 8vo.
- Text-Book; or Introduction to the Study of Mechanics and Engineering. W. J. M. Rankine and E. F. Bamber, C. E. With numerous diagrams. London. 12mo. \$3.50.
- Mechanics. New Course of Industrial Mechanics. M. Leon Pochet. Paris (French). 8vo, illus. \$4.60.
- The Operative Mechanic's Workshop Companion. 11th ed., revised and enlarged. W. Templeton. 18mo. London. 5s.
- Theoretical and Practical. James Hann. London. 8vo. 6s.
- Treatise on—Comprising the Course at the "Ecole Polytechnique." H. Resaz. Paris (French). Vol. I. 8vo. \$3.80.
- Workshop. The Amateur—By the author of "The Lathe and its Uses." New ed. London. 8vo. 6s.
- Milk Analysis. A Practical Treatise on the Examination of Milk and its Derivatives, Cream, Butter and Cheese. J. Alfred Wanklyn. London. 8vo. 5s.
- Mines. Reports of Inspectors for 1872. Parliamentary Report. London. 3s.
- Naval Architecture. An Elementary Treatise on Laying of Wood and Iron Ships. Samuel J. P. Thearle. London. Text, 12mo, plates 4to. \$1.25.
- Navigation. Tables for the Exact Computation of Distances at Sea. F. L. Roax. Paris (French). 8vo. \$0.60.
- Patents. Reports for 1872, of the Commissioners of Patents for Inventions. With Plan. Parliamentary Report. London. 8d.
- Certified Copy, Specifications and Drawings of Patents issued from the United States Patent Office for July, 1873. Washington. Large 8vo.
- General Index of the Official Gazette and Monthly Volumes of Patents of the United States Patent Office. Official Gazette, January to December inclusive; Monthly Volumes, July to December inclusive, 1872. Washington, 1873. 8vo.
- Photography, General Treatise on—D. V. Monckhoven. 6th ed. Paris (French). 8vo, illus. \$6.00.
- Physical Condition of the Globe, Observations relative to—made in Brazil and Ethiopia. A. d'Abidil (French). 4to. 15s.
- Physics, Course of—M. M. Pichot and Lechat. Paris (French). 8vo. \$3.20.
- Elementary Treatise on—Ganot. Translated by E. Atkinson. 6th ed., revised and enlarged. London. 8vo, illus. 15s.
- The Application of—to Science, Industry and Art. Guillem.n. Paris (French). Royal 8vo, illus. 20s.
- Quaternions. Introduction to—P. Kelland and P. G. Tait. With numerous examples. London. 8vo. 7s. 6d.
- Railroad Laws, The General—of the State of Ohio, in force January 1, 1874, together with certain other Laws and the Provisions of the Constitution of the State affecting Railroad Corporations, with notes of the decisions of the Supreme Court of Ohio, relating thereto. James A. Wilcox. Cincinnati. 8vo. \$5.00.
- Railroads. Complete Treatise on Cheap Railroads. C. A. Oppermann. Paris (French). 2 vols. \$14.50.
- Practical Manual of Military Railroads. Elie Issalene. Paris (French). 12mo, illus. \$1.00.
- Railway Accidents. Return of—for 1872. Parliamentary Report. London. 2s.
- Tyler's General Report on—in 1872. Parliamentary Report. London. 6d.
- Reports of Inspectors on—May to Aug., 1873. Part 5. Parliamentary Report. London. 4d.
- Rapid Reckoner and Commercial Calculator: a New, Practical and Scientific System of Calculation, unequalled for Simplicity, Brevity and Accuracy. Also, a Series of Original, Useful and Convenient Tables. Christian Ropp, Jr. Hamilton, O. 18mo. \$1.00.
- Retaining Walls. Surcharged and Different Forms of—James S. Tate. London. 8vo. \$0.80.
- Scientific Instruction. Third Report of Commission. Parliamentary Report. London. 8d.
- Ships. On the Stowage of—and their Cargoes. Robert White Stevens. 6th ed. London. 8vo. 21s.
- Steam and Its Uses. Dionysius Lardner. New ed. London. 8vo. 2s.
- and the Steam Engine. George G. Webster. Manchester. 12mo. 1s.
- Engine. Construction and Management of Stationary, Semi-Movable, Movable, Locomotive and Marine. Gaudry and Ortolan. (French.) 8vo. 25 f.
- Study on the new Marine Steam Engine. A. Mallet. (French.) 8vo. 5 f.
- Strength of Materials. A. J. Courtin. 2d ed. Mons. (French.) 8vo. \$3.20.
- Sugars, Refined—Minutes of the International Conference held in Paris, May, 1873. Parliamentary Report. London. 1s. 5d.
- Tables and Formule. Professional Papers of the Corps of Engineers, U. S. A., No. 12. Tables and Formule useful in Surveying, Geodesy and Practical Astronomy, including elements for the projection of Maps, and instructions for field Magnetic Observations. Washington. 8vo.
- Tactics. A Précis of Modern Tactics. Maj. Robt. Home, R. E. London. 8vo, illus. \$4.25.
- Telegraph, The Electric—in France and Algiers, from its Origin till January, 1872, preceded by a Description of the Aerial Telegraph. Alfred Etendard Montpellier. (French.) 2 vols. 8vo. \$7.20.
- Tinsmith's Cyclopaedia and Index. Containing Rules for Cutting Tinware, and Diagrams illustrating same, with Recipes for Japanese Tinware and various Compositions. New York. 8vo. \$1.50.
- Trade Marks. A Treatise on the Law of—F. M. Adams. London. 8vo. 5s.
- War. Campaign of 1870-71. The Operations of the First Army, under General von Steinmetz, to the Capitulation of Metz. Based on the Records of the Headquarters of the First Army by A. von Schell, Major of the General Staff. London. 8vo, illus. 10s. 6d.



War, Franco-German. The Operations of the First Army under General von Goeben. Compiled from the Official War Documents of Headquarters of the First Army. A. von Schell. London. 8vo, illus. \$4.50.

— Franco-German, 1870-71. First part. 3d section, the Battles of Wörth and Spicheren, from the German Official Account. 8vo. 5s.

Watch Work. A Treatise on—Past and Present. Rev. H. L. Nelthropp, M.A. London. 8vo, illus. \$2.50.

Weaving, Theory and Practice of the Art of—by Hand and Power; with Calculations and

Tables for the use of those connected with the trade. John Watson. New and enlarged ed. Glasgow. 8vo, illus. \$6.25.

Workshop Appliances, including Descriptions of the Gauging and Measuring Instruments, the Hand-Cutting Tools, Lathes, Drills, Planing and other Machine Tools used by Engineers. C. P. B. Shelley. London. 12mo. \$1.50.

Yachts and Yachting, by Vanderdecken; being a Treatise on Building, Sparring, Canvassing, Sailing and the General Management of Yachts. With Remarks on Storms, Tides, etc. London. 8vo. 21s.

## LIBRARY AND MUSEUM.

### ADDITIONS IN JANUARY, 1874.

NOTE.—Members and others are asked to contribute regularly to the library of the Society, copies of government, municipal, railway, canal and other reports, specifications, profiles, maps, photographs and like matter, making up the record of engineering operations for the past or present, and to inform the Secretary where such may be had. Duplicate copies are desired, for transmission to foreign societies in return for works collected and sent to this library by them; also for exchange with members and others who wish complete sets referring to particular subjects. In order to gather material now considered of but little value, but of great future importance in the history of the public works of this country and a comparison of their economical results, donations are solicited of old reports or pamphlets, which in any way refer to their construction or operation.

### DONATIONS ARE ACKNOWLEDGED AS FOLLOWS :

From Octave Chanute, C. E., New York: Report of the Erie Railway Co. to the Stockholders, for the nine months ending July 1st, 1872. New York.

— to the Stockholders and the Board of Directors of the Erie Railway Co., Sept. 2d, 1873. New York.

From Claxton, Remson & Haffelfinger, Philadelphia:

A Catechism of the High Pressure or Non-Condensing Steam Engine, by Stephen Roper. Philadelphia, 1874.

The Civil Engineer's Pocket-Book, by John C. Trautwine, C. E. 8th thousand, Revised and Enlarged. Philadelphia, 1874.

From C. Douglas Fox, C. E. London: On the Size of Pins for Connecting Flat Links in the Chains of Suspension Bridges, by Sir Charles Fox. London.

From E. P. Hanaford, C. E., Montreal, Canada:

Description of the International Bridge constructed over the Niagara River, near Buffalo. Toronto, 1873.

From Gen. A. A. Humphreys, Chief of Engineers, U.S.A. Washington, D.C.: Annual Report of the Chief of Engineers to the Secretary of War, for 1873. Washington.

Professional Papers of the Corps of Engineers U. S. A., No. 12. Tables and Formule useful in Surveying, Geodesy and Practical Astronomy. Washington, 1873.

From the Institution of Mechanical Engineers, Birmingham, England: Proceedings—29 and 30 July, 1873, Cornwall Meeting, Part I. Birmingham.

From John W. Nystrom, C. E., Philadelphia:

Principles of Dynamics, by John W. Nystrom. Philadelphia, 1874. (2 copies.)

From G. P. Putnam's Sons, New York: Machine Construction and Drawing, by Edward Tompkins. New York, 1873. Steam and the Steam Engine, Land, Marine and Locomotive, by Henry Evers. New York, 1872. (2 copies.)

From Charles B. Richards, M. E., Hartford, Conn.:

Specimens of Iron broken under Tensile Strain, illustrating the Influence of Shape on the Apparent Strength.

From the Editors and Publishers; (D. Appleton & Co., New York):

The American Cyclopaedia, a Popular Dictionary of General Knowledge, Vol. IV. New York, 1874.

From Joseph M. Wilson, C. E., Philadelphia:

Design adopted for the Passenger Depot, Baltimore and Potomac R. R. at Washington. Photograph and Printed Specification.

Views of East Span of the Monongahela Bridge. Pittsburgh. 2 Photographs.

### ADDITIONS BY PURCHASE.

Specifications and Drawings of Patents issued from the U. S. Patent Office, for July, 1873. Washington.

Uniform Trade List Annual. New York, 1873.



## ANNOUNCEMENTS.

**MEETINGS**—The next evening meeting of the Society will be held Wednesday, February 18th, at 8 o'clock P. M., when an examination into the "Elements of cost of railroad traffic" will be made, with a view to determine the same under their appropriate heads, and to discover wherein and in what manner a reduction may be effected. It is hoped that railroad managers and others interested will take part, and contribute statements of the several items of cost as determined or observed by them. A memoranda of information desired has been published (Proceedings, page 58), to which reference is made.

The next stated meeting of the Board of Direction will be held Monday, March 2d, at 2 o'clock P. M., when reports of the Committee on Norman Medal will be specially considered.

The next afternoon meeting of the Society will be held Wednesday, March 4th, at 1 o'clock P. M., when ballots for members will be canvassed, and a paper read describing "The method pursued in replacing a stone pier on a pile foundation," by J. Albert Monroe, C. E. It is expected that a paper on the "Strains in draw-bridge spans and turn tables, and giving co-efficients of rolling friction, as determined by experiment," and one noting "Experiments on the proportion which the flow of streams bears to the rainfall," will then be presented.

At the evening meeting of the Society, to be held Wednesday March 18th, "Tests of materials used in construction and testing machines," the subject of consideration at the meeting held January 21st, will be taken up. Mr. Richards paper, LXXIV, "Experiments on the tensile strength of bar-iron and boiler-plate," and Mr. Macdonald's, LXXIII, "Proportions of the heads of eye-bars" (herewith published), will be discussed, and other papers referring to the general topic will be presented. That the discussion may, in degree at least, be profitable and exhaustive, members are urged to communicate the informa-

tion they possess, relating to either of the heads specified in the previous announcement of this subject (Proceedings, page 58).

At the afternoon meeting of the Society, to be held April 1st, will be discussed, Prof. Thurston's paper on the "Resistance and physical properties of materials," read at the meeting February 4th, and to be published in March "Transactions."

**COMMENTS AND DISCUSSIONS**—On the papers published in "Transactions," are solicited from members, whether present at the meetings of the Society or not. They are urged to contribute selections from their note-books and other similar recorded experience, bearing upon the subjects considered; those seeking information are asked to suggest professional topics for discussion.

**PHOTOGRAPHS OF MEMBERS**.—By resolution of the Society, each member has been requested to furnish two photographs of himself, of the usual card size, as a means of promoting social recognition and intercourse. Those who have not complied with this request are specially asked to aid in making the collection complete, by speedily forwarding their photographs, endorsed with autograph and date.

**EXTRA POSTAGE AT LETTER RATES**—That is, three cents per half ounce, is collected by the New York Post Office on all packages of books, pamphlets and other printed matter, author's copy and photographs sent to the Society, which have *any writing* upon the wrapper except the address; otherwise the postage on such is but one cent per two ounces. The name of the sender or the contents of the package must *not* be written on the wrapper, but it may be printed.

**THE CONSTITUTION AND BY-LAWS** of the Society, as revised and adopted November 5th and January 7th, are sent out to members herewith as a supplement to this issue of "Transactions."

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## ADMISSIONS TO THE SOCIETY.

Dec. 31st, 1873....CAMP, JONATHAN, JR.....Jersey City, N. J.  
 Nov. 7th, "....CHRISTIE, JAMES.....Phillipsburgh, N. J.  
 Jan. 19th, 1874....HEMBERLE, EDWARD.....Chicago, Ill.  
 Dec. 20th, 1873....HOLLEY, ALEXANDER L.....Brooklyn, N. Y.

# AMERICAN SOCIETY OF CIVIL ENGINEERS.

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## PROCEEDINGS.

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### MINUTES OF MEETINGS.

(Abstract of such as may be of general interest to members.)

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#### OF THE SOCIETY.

FEBRUARY 18TH, 1874.—A stated meeting was held at 8 o'clock P. M.

A communication from Prof. R. H. Thurston, relating to a "Memorial of the American Metrological Society," in which Congress is asked to take action to insure, wherever practicable, a prompt adoption of a decimal system of weights and measures, was read and referred for consideration and report to a special committee, consisting of Prof. R. H. Thurston, Mr. E. P. North and Mr. J. J. R. Croes.

Letters were presented from members in regard to "proper charges for plans, specifications and drawings of water works and drainage, furnished to contractors and corporations, and for simple consultation upon engineering matters." \*

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\* An enquiry as to what is customary practice was submitted to several members. From the replies received, the following extracts are made :

One says : "I am constantly applied to, for opinions upon engineering subjects, patent processes, etc." "I think that Engineers ought now to claim compensation, as legal men do, for services of this character." "For a few years past I have adopted a rule to charge for such time, except to the profession and very intimate friends."

And again : "I charge, for consultations of less than a day, \$100 ; in more important cases, requiring much labor, \$500 as retainer, and \$100 per day, besides expenses of travel and board ; and in special cases, as trials in courts of law, I sometimes charge still more." "I suppose that the younger members of the profession would hardly venture upon such charges for fear of losing all applications ; but they should certainly have some standard higher than of those which I hear have often been made."

Another says : "The charge for such work necessarily varies much with the amount of labor required and the experience and standing of the Engineer employed. Some could properly charge, and collect without difficulty, five times as much as others. A fair rule for special work is to charge, in addition to the sum expended on assistants, etc., an amount for personal service for the time spent—twice what the Engineer can command when permanently engaged." "With regard to consultation also, there can be no fixed standard. My rule has been, when called as an expert, or on a commission, to charge, if engaged less than four days, \$100 and expenses ; and if engaged longer, \$25 per day and expenses."

Another says : "There seems to be in this country no standard of charges for Engineers. My practice in preparing plans, specifications, etc., is to charge for the time occupied, with a fair addition for the *know how*. My charges for advice vary according to the importance of the case. If it is an ordinary question I usually charge nothing, but if it is an important matter involving experience and acquired knowledge, such as the stability of a structure, or the best and cheapest method of accomplishing any work, I charge accordingly ; say from \$10 to \$50. This is generally governed by the importance of the work or advice, and the estimate made by the Engineer of the value of his services and experience."

Attention was called to the working model presented by Mr. S. T. Fuller, chief engineer Phil. Wil. & Balt. R. R., of the safety switch used on that road.

The subject for consideration, "Elements of Cost of Railroad Traffic" was announced; the following were presented, supplied in response to the circular\* issued, asking for details of the several items of cost; communications from Mr. J. D. Potts† and Charles Paine, C. E., with the latter, a compendium of tables, given in the "Annual Report of the Lake Shore and Michigan Southern Railway Co." for 1872; from William P. Shinn, C. E., the "Reports of the General Freight Agent of the Pittsburgh, Fort Wayne & Chicago Railroad," for 1865 and 1868; from Albert Fink, C. E., his "Investigation into the Cost of Transportation on American Railroads;"‡ from Mr. A. D. Briggs, the "Annual Report of the Board of Railroad Commissioners of Massachusetts," for 1872, and from Octave Chanute, C. E., a paper on the "Elements of Cost of Railroad Freight Traffic.§"

Mr. Paine's communication and enclosure, portions of the "Investigation into the Cost of Transportation on American Railroads," and of the "Annual Report of the Board of Railroad Commissioners of Massachusetts," and Mr. Chanute's paper, were read and discussed.

Further consideration of the subject was postponed to the meeting to be held April 15th.

MARCH 4TH, 1874.—A regular meeting was held at 1½ o'clock P. M. The vote upon admission to membership was closed, the ballots canvassed, and the following declared elected: Honorary Member, Horatio Allen, (late President of the Society) of South Orange, N. J.; Members, De Witt C. Coolman, C. E., of Ravenna, O., Theodore Cooper, C. E., of Cooper's Plains, N. Y., Edward C. Du Bois, C. E., of Arequipa, Peru, George W. Edge, Gas Engineer, of Jersey City, N. J., James H. Harlow, C. E., of Pittsburg, Pa., Louis H. Knapp, C. E., of Buffalo, N. Y., and Franklin C. Prindle, C. E., of Philadelphia, Pa.; and Juniors, Phineas Barnes, C. E., of Pittsburgh, Pa., and Albert J. Stahlberg, C. E., of Waterbury, Conn.

A paper by J. Albert Monroe, C. E., giving the "Method Pursued in Replacing a Stone-pier on a Pile Foundation," and the majority report of Committee on Norman Medal presented to the Board of Direction, were read; the latter was discussed and referred to the committee for amendment.

#### OF THE BOARD OF DIRECTION.

MARCH 2D, 1874.—A stated meeting was held at 2 o'clock P. M., and proposals for admission to the Society were considered.

The majority report of the Committee on Norman Medal, accepted

\* Proceedings, page 58.

‡ Book Notes, page 69.

† Railroad Gazette, Feb. 21st.

§ Transactions, page 381.

January 5th, and the "Code of Rules," presented February 2d, were taken up. After discussion, and consideration of the resolution of the Annual Convention, June 6th, 1872, constituting the committee, and that of the Board, December 1st, 1873, directing the committee to report a plan for awarding the prizes, the question was raised what power the Board had to revise a report presented for its information and not for its approval, and the Chair decided that the Board had no power to change the details of plans for the award of the Norman Medal as thus determined by the committee. The Secretary was authorized to announce, in accordance with the report of the committee, that papers to compete for the medal will now be received.

A committee consisting of Messrs. Charles Macdonald, Octave Chanute and John Bogart, was appointed to report at the next meeting of the Board a detailed plan for the Sixth Annual Convention of the Society, to be held in New York, June 10th and 11th next.

## BOOK NOTES.

THE COST OF RAILROAD TRANSPORTATION\*—Although a subject receiving at this time much popular attention, is but little understood. Mr. Fink, in an examination into its elements and principles, proceeds to analyze the results of the operation of one road, to institute comparison with others, and thus to ascertain the existing differences and the reasons therefor. The Louisville & Nashville and Great Southern R. R. Co., operates 738.25 miles of road, including trunks and branches. These are of various characteristics; their expense accounts having been kept separate, comparison may be made between lines operated under various conditions and circumstances, but by one management.

The mode generally adopted to express the cost of railroad transportation, in terms of the proportion of the operating expenses to the earnings, is not sufficient to determine whether a road is as cheaply operated as is practicable; every item of expenditure must be analysed in detail, to see whether it has been reduced to a minimum.

The causes which produce differences in the cost of railroad transportation are considered under these general heads: the character of the road, the cost of labor and material, the speed of trains, the amount and nature of business done, and the cost of

road and equipment. To ascertain how far these causes, singly and combined, influence the cost of transportation on the same or different roads, the cost of running one train one mile, is taken as a unit of comparison.

In considering the "character of the road," its length, curvature, the height and distribution of grades, the manner of construction, whether permanent or temporary, and the nature of the country as influencing the cost of maintenance, are all to be taken into account. Thus, for illustration, on a comparatively level road, an engine of 16x24 inch cylinder readily draws 45 loaded freight cars, of 10 tons each net—while on one division of the L. & N. R. R. it draws only 17 cars, and on one division of the N. & S. A. R. R. it could draw only 13 cars—at a cost, therefore, per ton mile, due to differences of grades and curvatures on these divisions, respectively 2.53 and 3.54 greater than if they were level.

An examination into the "cost of labor and material," will show that while there is not much difference in the prices of skilled labor, common labor may vary from \$1 to \$1.50 and more, per day, which directly affects the relative cost of road repairs. The average cost per train mile in 1872 for fuel, on the Penn. R. R. was 6.5 cents, on the Lake Shore & Mich. South. R. R. 14.8 cents, and on the Boston & Albany 20.8 cents.

The effect of the "speed of trains" is illustrated by reference to tables of the relative cost of moving one ton gross one mile, in

\* An Investigation into the Cost of Transportation on American Railroads, with Deductions for its Cheapening, by Albert Fink, C. E., Vice-President and General Superintendent of the Louisville & Nashville and Great Southern Railroad. - Louisville, 1874.

passenger and freight trains on the "Main Stem" 185 miles long, and the "Memphis Branch" (46.4 miles long) of the L. & N. and G. S. R. R., which show that on passenger trains, compared with freight trains, it costs about twice as much—the speed being two to two and one-half times as great.

The "amount and nature of business transacted" determine the operating expenses, which may be divided into three classes—constant expenditures, or those which must be incurred without regard to the number of trains, as the care of the road-bed, bridges, &c.; those which are in some measure reduced with an increase of the number of train miles, but not in the same ratio, as general expenses, superintendence, the cost of agencies, &c., and those which directly increase with the number of trains—as engineers' wages, engine repairs, fuel, &c. To show how an increase of traffic may reduce the cost, reference is made to the "Main Stem." In 1867, 8.55 trains, and in 1873, 17.49 trains were run daily, at a cost per freight train mile of \$1.97 and \$1.59, and per freight ton mile of 2.19 cents and 1.44 cents, respectively. The nature as well as the amount of business greatly influences the cost of transportation on different roads; on some a large part of the freight is carried in one direction and only a small part in the other; on others, the amount of traffic each way is nearly equal. A road doing only a local business will carry a less average train load than one chiefly doing a through business, and the cost of transporting local freight will be so much greater.

The interest on the "cost of road and equipment" chargeable to operating expenses, is an item belonging to "constant expenditures"—a fixed yearly sum, distributable according to the amount of work done. Computed at 7 per cent. per annum, it was on the "Main Stem" in 1867, 50.05 per cent., and in 1873 (although the capital had been increased \$2,000,000), 37.87 per cent. of the other operating expenses; and per freight ton mile —1.14 cents and 0.55 cents. Similarly on the "Richmond Branch" (from 25.62 to 33.46 miles long), it varied during five years from 127.34 to 243.12 per cent. of the cost of operation, and the cost per ton mile—including interest—from 7.62 to 11.56 cents. On the Penn. R. R. in 1872, the cost per ton mile was 0.83 cents, and including interest, 1.05 cents.

This general view of the causes of so great diversity in the cost of railroad transportation, the service performed being the same, shows beyond a doubt that it is impossible to secure uniformity in rates therefor, with regard to the rights of those who perform the service.

There are expenditures common to passenger and freight traffic which cannot be separated and accurately charged to either class of train service; as those for maintenance of roadway and track, water-stations, buildings, the general expenses, &c. In railway reports, where the cost of the two branches of traffic is stated separately, a certain proportion of these expenditures is generally allotted arbitrarily to each—thus, on the Penn. R. R., one-third is charged to passenger and two-thirds to freight, and on the Erie Ry., two-fifths to passenger and three-fifths to freight. In the reports of the L. & N. R. R. Co., and the tables here given, the division is based upon the relative passenger and freight train mileage, which seems to be as nearly correct as is possible to estimate it.

The question arises as to the relative expenditure in the repair of rails for each class of train. From the tables it appears that, including the locomotive, the gross weight of a freight train is from two to two and one-half times that of a passenger train, which is about the inverse rate of their speeds, whence it does not seem unreasonable to estimate the cost of repairs of rails and adjustment of track per mile run, the same for both. The average cost of repairs per train mile, during seven years, on the "Main Stem," was 8 cents; and in 1872, on the Penn. R. R., 8.6 cents, on twenty-eight Massachusetts railroads, 9.2 cents, on the Lake Shore & Mich. South. R.R., 9.6 cents, and on the Mobile & Ohio, 9 cents.

The cost, per passenger train mile, in seven years, varied on the "Main Stem" from \$1.28 to \$1.67, and on the "Memphis Branch," from \$1.16 to \$1.52; in 1872, on the Penn. R. R., it was \$1.06; in 1873, on the Erie Ry., it was \$0.94, and the cost, per train mile, freight and passenger, in 1872, varied on the twenty-eight Massachusetts railroads from \$0.86 to \$1.79.

The cost per car mile on passenger trains, exclusive of interest on investment, varied in seven years on the "Main Stem" from 26.28 to 30 cents, and in five years, on the "Memphis Branch," from 27.55 to 40.56 cents; including interest, these were for the "Main Stem" from 37.15 to 45.02 cents, and for the "Memphis Branch," from 45.08 to 65.91 cents. In 1872, the cost per car mile of passenger traffic on the Penn. R. R. was 21.42 cents, and on the Mobile & Ohio 32 cents.

The next inquiry is as to the cost for the load carried in the cars. Passenger trains carry passengers in regular, and in sleeping or parlor cars; baggage in baggage cars; ex-

press matter in baggage or special cars; and the mail in baggage or postal cars; the cost of performing each kind of service depends much upon the mode by which it is performed. The cars used on passenger trains differ much in weight—thus, sleeping cars generally weigh 64,000 pounds and express cars 24,000 pounds. If the charges for services performed on passenger trains are to be regulated and assessed on all parties using the train, in accordance with the cost of that service, the paying and dead weight carried for each kind of load must be known.

From tables giving this information in regard to the various roads operated by the L. & N. R. R. Co., the cost of carrying each class of load in 1872-3 on the "Main Stem" is computed, with results as follows: Cost per mile per ton of gross weight, 1.27 cents, and of net weight 21.35 cents; for every ton of paying weight, 15.8 tons of dead weight (exclusive of locomotives) were carried. Passenger and baggage carried one mile in passenger cars for 1.78 cents; in sleeping cars for 4.59 cents, and in passenger and sleeping cars for 2.3 cents; for each passenger in passenger cars 1.3 tons, in sleeping cars 3.5 tons, and in passenger and sleeping cars 1.7 tons—dead weight were carried. Baggage (50 pounds), for each passenger (150 pounds), carried one mile for 0.27 cents—for which 350 pounds dead weight were carried. Express matter carried per ton mile for 14.17 cents, mail matter in baggage cars for 11.10 cents, and in postal cars 33.4 cents; for each ton, paying weight, of express matter 10 tons dead weight—of mail matter in baggage cars, 7.75 tons, and in postal cars 25.29 tons—dead weight were carried.

In the foregoing the estimate of cost of the sleeping car service is based upon the average cost per gross ton hauled: if, however, this service is charged only with the additional cost incurred on its account, which per mile run is 10.55 cents, the above items become: Cost per mile per ton of gross weight, 1.65 cents; passenger and baggage carried one mile in passenger and sleeping cars for 2.15 cents; express matter carried per ton mile for 18.5 cents; mail matter in baggage cars for 14.4 cents, and in postal cars for 43.48 cents, and baggage for each passenger, carried one mile for 0.34 cents. These changes are made upon the assumption that the engine has enough surplus power to haul the sleeping cars. Should, however, heavier locomotives, or more than one be required, additional expense must be incurred, which, as well as the cost of running a second train instead, is estimated and the results given.

From the investigations thus made it will

be conceded that the problem of ascertaining the cost of passenger train service is rather a complicated one, which will not permit the enunciation of general rules applicable to all cases that may arise in practice.

An examination is made into the "cost of mail and postal service" which railroad companies of this country are required to perform, and of the principles on which compensation therefor is and should be allowed. From this it appears, that compensation, if based upon the cost of transportation, should be regulated with regard to the variations in this cost on different roads and under different circumstances; that the cost is not so much dependent on the net weight of the mail as upon the mode in which it is carried, and hence, that the accommodations furnished, measured by the gross weight, is the proper basis for compensation.

The tables annexed show, in minute detail, the cost of railroad transportation on the "Main Stem," and the several branches, for from two to seven years, ending with 1873—the cost per train mile on the "Main Stem," the "Knoxville Branch," and the "Memphis Line," for the year ending June 30th, 1873, and the weights of each class of locomotive and car used. These tables, derived from the reports of the L. & N. R. R. Co., comprise data sufficient for the investigator to draw his own conclusions from, if he does not accept those here given.

It is Mr. Fink's purpose to complete this investigation with an examination into the elements of cost of freight traffic similar to that he has given of passenger transportation, and include six or eight additional tables, showing the cost of railway traffic on some of the leading roads in the country. His principal object is to cause a discussion of this important matter, and thereby elicit valuable information. To this end he asks criticism of the views expressed, or corrections of any of the statements made in the work thus far completed.

**THE BUFFALO INTERNATIONAL BRIDGE.\*—**The chief points of interest connected with the erection of this important structure, are clearly presented by Mr. C. S. Gzowski, the contracting engineer, in a recently published quarto volume, fully illustrated by 21 large lithographic plates to scale.

The charter was obtained in 1857, but the capital required for the construction, £275,000, was not raised until 1870, when the contract

\*Description of the International Bridge constructed over the Niagara River, near Fort Erie, Canada, and Buffalo, U. S. A. Toronto, 1873.



was let at \$1,000,000; the total cost of the bridge and its connections with the New York Central and the Buffalo & Lake Huron railroads, was about \$1,500,000. Work was begun early in 1870, and the first locomotive crossed October 27th, 1873.

The bridge is in two parts—one 1,967½ feet long from the Canada shore across the Niagara river to Squaw island, consists of seven fixed and one draw span; of these, the first three, and the last span are each 197 feet long, and the second three, 248 feet; the draw span, which is between the sixth and seventh fixed spans, is 364 feet long, and has two openings of 160 feet each. The other part, 517 feet long, across Black Rock harbor, consists of one fixed span 219 feet, and one draw span 218 feet long. The two parts are connected by an embankment 1,166 feet long, on a curve of 1,910 feet radius—the total distance between the outer ends of the two parts being 3,651½ feet.

The water in the main channel varied in depths from 10 feet at pier 1, to 48 feet at pier 5, and 9 feet at pier 8.

The chief difficulties to be overcome were due to the masses of heavy ice in the stream to be resisted; the great velocity of the water, reaching, at times, nearly 12 miles an hour, and the impossibility of determining in advance the nature of the bottom in the deepest part.

Caissons with water-tight sides and bottoms were used for the foundations, except at the abutments—these were towed into place, sunk by filling in with concrete, and when firmly grounded, the masonry was built up in them. The first five were sunk to the rock; for the others, preparation was made by driving piles, which were sawed off close to the bottom, and the spaces between them rammed full of stone.

The velocity of the current was so great that a diver could not in any case examine the bottom until protected by a caisson anchored above the pier site: in the deepest

water, examinations were made but a few feet at a time, the caisson was then lowered to a new position, and thus the whole site was gone over. On the site of the first three piers, the rock was almost bare, there being only a few boulders which the divers removed—the river bed where the next two piers were located, and where the water was deepest, was a complete mass of boulders and gravel over the rock, and from 10 to 15 feet thick.

Two caissons were lost in the attempt to found these piers; then a plan was adopted of sinking first a bottomless caisson, with sharp edges and hollow walls, and to force it down to bed rock by weighting, and dredging out the enclosed material. It was made with pointed ends, and its steadiness in the current increased by the addition to the lower end of a fin or tail about 25 feet long. In placing it, six steam tugs and two barges were employed; to hold it in position after it was sunk, eleven anchors of three or four tons weight each, were required. When down to the bed rock a portion of the stern was cut away, and the water-tight caisson in which the masonry was to be built, floated into position.

In erecting the superstructure (which was a Pratt quadrangular truss) pontoons held in place by cables were used, five for the short and six for the long spans. On these were built a lower scaffolding to support the trusses, and an upper one, with traveling cranes. The trusses, after erection, were lowered into place by allowing water to flow into the pontoons.

There is evidently a slip of the pen on page 36, where is stated "while the rate of movement is only *doubled*, the force of the water is increased according to the *sixth* power of the velocity." In estimating the effect of ice upon a pier when considerable velocities have to be encountered, it is a question also, whether impact ought not to be considered. The method pursued, seems however, to be practically safe.

#### NEW BOOKS ON

### ENGINEERING AND TECHNOLOGY.

Under this head will be announced new books on these and kindred subjects in English, French and German, which may be professionally useful to members of the Society.

At the present rates of duty and exchange, the cost of imported books may be estimated in federal money, at one shilling equal to 50 cents, one franc to 37 cents., and one thaler to \$1.23.

Architecture, History of the modern Styles of of ——. 2d. ed., forming the 4th Volume of the new ed. of the History of Architecture. James Ferguson. London.

8vo. 31s. 6d. (Correction of title on page 63.)

Architecture—National Cottage: or Homes for every One—chiefly low-priced Buildings.



- for Towns, Suburb and Country. E. C. Hussey, Architect. New York. 4to, illus. \$6.00.
- Astronomy, A Treatise on—Spherical and physical, with astronomical problems and solar, lunar, and other astronomical Tables, for the Use of Colleges and Scientific Schools. William A. Norton. New ed. New York. 8vo, illus. \$3.50.
- Building Construction. Timber and Stone Work. R. Scott Burn. New York. 12mo, illus. 2 vol. \$1.50.
- Bridges, of the present Day—Part 1st. Iron Bridges. Auchen Mayer (German), folio. Chemistry, Birth of—G. F. Rodwell, F.R.A.S., etc. London. 12mo, illus. \$1.25.
- Inorganic—T. E. Thorpe, Ph. D. New York. 12mo. \$1.50.
- W. B. Kemshead, F. R. S. New York. 16mo. \$0.75.
- Coal Fields of Gloucestershire and Somersetshire and their Resources. John Anstie, B. A. London. 8vo. \$3.00.
- Coloring Matter, Treatise on Bodies containing—obtained from Coal Tar. P. Bolley and E. Kopp. Trans. from the German. Edited by Dr. L. Gautier, Paris (French). 8vo, illus. \$4.00.
- Corporations, New York (State).—The Act authorizing the Formation of—for manufacturing, mining, mechanical, chemical, agricultural, horticultural, medical or curative, mercantile or commercial Purposes. Passed Feb. 17, 1848. To which are added Notes, Forms, and Index. New ed., with all the Amendments. New York. 12mo. \$0.50.
- Curves. The field practice of Laying out—John C. Trautwine, C.E. 9th ed. Revised and enlarged. Philadelphia. 12mo.
- Drawing, Free Hand—A Guide to ornamental, figure and landscape Drawing. 2d ed. New York. 18mo, illus. \$0.50.
- Mechanical—with Instructions. London. 4to. 2s. 6d.
- Energy, Conservation of—With an Appendix, treating of the vital and mental Applications of the Doctrine. Balfour Stewart. New York. 12mo. \$1.50.
- Engineer. How to become a successful Engineer: being Hints to Youths intending to adopt the Profession. Bernard Stuart. 6th ed. New York. 18mo. \$0.50.
- Excavations and Embankments—A new Method of calculating the cubic Contents of—by the aid of Diagrams, together with Directions for estimating the Cost of Earthwork. John C. Trautwine, C. E. 5th ed. Revised and enlarged. Philadelphia. 8vo.
- Fortification, Elements of permanent—Prof. D. H. Mahan. New ed. Revised and edited by Col. J. B. Wheeler, Prof. of Civil Engineering, U. S. Acad. West Point. New York. 8vo, illus. \$6.50.
- Geography. Physical—M. F. Maury, LL.D. New York. 4to, illus. \$2.25.
- John Young, M.D. New York. 12mo. \$1.50.
- Geology of France. Amedei Burat. Paris (French). 8vo. \$6.40.
- Geometry, Elementary Treatise on solid—W. S. Aldis. 2d ed., revised. Cambridge. 8vo. \$4.00.
- Mechanic's Geometry, plainly teaching the Artizan in every Branch of Industry the constructive Principles of his Calling. Robert Riddell. Philadelphia. 4to, illus. \$5.00.
- Treatise on practical solid descriptive. W. T. Pierce. London. 4to. \$6.25.
- Hydraulics of Great Rivers. The Parana, the Crugway, and the La Plata Estuary. J. J. Revy, C.E. London. 4to, illus. \$17.00.
- Iron. Molecular Changes Produced in—by Variations of Temperature. Prof. R. H. Thurston. Philadelphia. 8vo. \$0.75.
- Ores of Missouri and Michigan—by Raphael Pumpelly, late Director of the Geological Survey of Missouri, T. B. Brooks, State Geologist, Lake Superior Iron District, and Adolph Schmidt, Assistant in the Geological Survey of Missouri. New York. 2 vols., 8vo, atlas in folio. Illus. \$20.
- Trade, Guide to—of Great Britain, containing an elaborate Review of the Iron and Coal Trades for last year; Addresses and Names of all Ironmasters; with a List of blast Furnaces, iron Manufactories and other Statistics and Information respecting Iron and Coal, which may be useful to Merchants, Bankers, Brokers, Coalowners, Ironmasters and all Others interested in the Iron Trade. Samuel Griffith. London. 8vo, illus. 21s. (Partial title on page 63.)
- Lightning Rods, Instruction on—adopted by the Academy of Science. Paris (French). 12mo, illus. \$1.00.
- Manufactures. The Wonders of Industry—a Description of the principal modern Manufactures. Louis Figuier. Paris (French). Vol. 1. 8vo, illus. \$4.00.
- Measurements, An Introduction to physical—Dr. J. Kohlrausch, Prof. at the Darmstadt Polytechnic School. New York. 8vo. \$2.50. (A reprint; full title on page 54.)
- Mechanism, A new universal Guide to—applicable to all Bodies which communicate Motion. M. Jacquemier. Paris (French). 8vo. \$0.60.
- Minerals and Stones. The microscopic Characteristics of—F. Zirkel, Leipzig (German). 8vo. 33t.
- Minerals—Microscopy of important—H. Rosenburch. Stuttgart (German). 8vo, illus. 16s.
- Mines, Conversation on—William Hopton. 5th ed. Manchester. 8vo. 3s.
- Lectures delivered at the School of Mines of Paris; on the most profitable and practicable Manner of working Mines. 1st and 3d course. M. J. Callon. Paris (French). 2 vols. 8vo, text. 2 vols. 4to, plates.
- Mining Engineers, Transactions of the American Institute of—Vol. 1. May, 1871, to February, 1873. Philadelphia. 8vo. \$5.00.
- Navy, The Iron Clad—M. P. Dislere. Paris (French). 8vo, illus. \$2.80.
- Ocean, The—Its Tides and Currents and their Causes. W. L. Jordan. London. 8vo. 21s.
- Ordnance, Annual Report of the Chief of—to the Secretary of War for the fiscal Year ending June 30, 1873. Washington. 8vo.
- Ore, Rich Lumps of—Studies of the Ores of Cornwall. M. L. Moisenet. Paris (French). Atlas. 8vo, text. Plates. \$6.00.
- Patents. Certified Copy, Specifications and Drawings of Patents issued from the United States Patent Office for August and September, 1873. Washington. Large 8vo. 2 vols.
- Reports of Cases, arising under Letters Patent for Inventions. Determined in the Courts of the United States. Samuel S. Fisher, Counsellor at Law. Vol. 5. Cincinnati. 8vo. \$25.00.
- Railroads and Electric Telegraphs—Studies on—with a view to national Defense. Capt. J. B. Engene, Belgian Army (French). 2 vols. 8vo. 12f.
- Railroads—23d official annual Report on—containing an analytical Account of the

- History, Management, and financial Condition of French and foreign Railroads, and a special Collection of Laws referring to the Same. F. Dubois. Paris (French). 12mo. Railway Law in Illinois. The Relations of Railroads to the People. Frank Gilbert. With an Introduction by Gov. J. M. Palmer. Chicago. 8vo. \$3.50.
- Reservoirs. A Treatise on—M. Graeff. Paris (French). 4to, with atlas of plates. 20f.
- Storage—On the Designing and Construction of—Arthur Jacob. New York. 18mo. \$0.50.
- Science and Mechanics. A Treatise on ancient and modern—Stuttgart (German). Part I. 4to. 2s.
- Record for 1874. A Compendium of scientific Progress and Discovery. Edited by Alfred F. Beach. New York. 12mo. illus. \$2.50.
- The Principles of—A Treatise on Logic

- and Scientific Method. By W. Stanley Jevons. London. 2 vols. 8vo. \$9.00.
- Ships, Ironclads and Merchant Ships, giving popular Proofs of Errors in the current Mode of estimating the Stability of Ships, with an Outline of a correct and rapid Mode of Calculation, proved by mathematical Reasoning. Rear-Admiral E. G. Fishbourne, C. B. London. 8vo. \$4.25.
- Steam Engine. Treatise on the Compound Steam Engine. John Turnbull, Jr. New York. 18mo. \$0.50.
- Tables, Barometrical and Hypsometrical—for calculating Heights; with seductions for their Use. M. R. Radan. Paris (French). 12mo. \$0.75.
- Vienna Exposition—Science and Art at the—F. Peicht. Stuttgart (German). 8vo. 1½t
- Wonders of Industry. Steam Engines, Steam Ships, and Railroads. 8th ed. A. Mangin, Tours (French). 8vo.

## LIBRARY AND MUSEUM.

### ADDITIONS IN FEBRUARY, 1874.

NOTE.—Members and others are asked to contribute regularly to the library of the Society, copies of government, municipal, railway, canal and other reports, specifications, profiles, maps, photographs and like matter, making up the record of engineering operations for the past or present, and to inform the Secretary where such may be had. Duplicate copies are desired, for transmission to foreign societies in return for works collected and sent to this library by them; also for exchange with members and others who wish complete sets referring to particular subjects. In order to gather material now considered of but little value, but of great future importance in the history of the public works of this country and a comparison of their economical results, donations are solicited of old reports or pamphlets, which in any way refer to their construction or operation.

### DONATIONS ARE ACKNOWLEDGED AS FOLLOWS:

- From the American Institute of Mining Engineers:  
Transactions of—Vol. I. May, 1871, to February, 1873. Philadelphia, 1873.
- From John Bogart, C. E., New York:  
Report of the Directors of the New York Meteorological Observatory, Department of Public Parks. New York, 1873.
- From Hon. A. D. Briggs, Springfield, Mass.:  
Fifth annual Report of the Board of Railroad Commissioners, January, 1874. Boston. (3 copies.)
- From the Civil Engineer's Club of the Northwest, Chicago, Ill.:  
Papers read before the Club, as follows:  
Notes on Lake Harbors, by Col. D. C. Houston.  
Spiral Motion in Nature, by J. R. Straghan, C. E.  
The Jurisprudence of Surveys, by S. S. Greeley, C. E.
- From Joseph P. Davis, C. E., Boston, Mass.:  
Annual Report of the City Engineer for the year 1873. Boston. (2 copies.)  
Report of the Cochituate Water Board. Boston, 1874. (2 copies.)
- From Gen. A. B. Dyer, Washington, D. C.:  
Annual Report of the Chief of Ordnance, for the Year ending June 30, 1873. Washington.
- From S. M. Felton, C. E., Philadelphia, Pa.:  
First annual Report of the Board of Directors of the Denver & Rio Grande Railway, April 1, 1873. Philadelphia.  
Steel Rails, Axles and Forgings. Testimony to their Economy and Safety. Philadelphia, 1870.
- From Albert Fink, C. E., Louisville, Ky.:  
An Investigation into the Cost of Transportation on American Railroads, with Deductions for their Cheapening. Albert Fink, C. E. Louisville, 1874.
- From M. N. Forney, M. E., New York:  
Sixth annual Report of the American Railway Master Mechanics' Association in Convention at Baltimore, May 13-15, 1873. Cincinnati.
- Seventh annual Report of the Proceedings of the Master Car Builders' Association in Convention at Boston, June 11-13, 1873. New York.

From S. T. Fuller, C. E., Philadelphia:  
A working Model of Wharton's Safety Railroad Switch.

The Relation of the Federal Government to the Railroads, in respect to postal Service, by David A. Wells. New York, 1874.

Thirty-sixth annual Report of the Philadelphia, Wilmington & Baltimore R. R. Co., for the Year ending October 31, 1873. Philadelphia.

From James Harlow, C. E., Pittsburgh, Pa.:

Third Annual Report of the Water Commissioners of the City of Lowell, January 1, 1873. Lowell.

From Hastings & Co., New York:  
Daily Record, or Everybody's Diary for 1874. New York.

From Prof. Joseph Henry, Washington, D. C.:  
Annual Report of the Board of Regents of the Smithsonian Institution for 1863. '64, '65, '66, '67, '68, and '71, 7 volumes. Washington.

From Samuel Keefer, C. E., Brockville, Canada:

Letter to the Secretary of State from the Canal Commissioners, respecting the Improvement of inland Navigation of the Dominion of Canada, 1871.  
Maps of the Dominion of Canada, 1871.

From Col. William E. Merrill, Cincinnati, Oh.:

Improvement of the Ohio, Monongahela, Great Kanawha and Wabash Rivers. Water Gauges on the Mississippi and its Tributaries. Washington, 1873.

From Capt. R. R. Moffat, Brooklyn, N. Y.:

Breech-loading Field Piece. 2 photographs.

From Charles Faine, C. E., Cleveland, O.:

Samuel H. Turrill vs. Illinois Central R. R. Co. and others. In the U. S. Circuit Court, Northern District of Illinois. Repairs of Rails, Testimony and Pleadings. 2 volumes. Chicago, 1873.

From Prof. J. E. Nourse, Washington, D. C.:

The Maritime Canal of Suez. Washington, 1873.

From Public Library of the City of Boston:

Bulletin No. 28. List of the more important

Books placed in the Library during October, November and December, 1873.

Index to the Catalogue of Books in the Bates Hall of the Library of the City of Boston. First Supplement. Boston, 1866.

Lower Half, Class List for Books in the Arts and Sciences. 2d Ed., September, 1871.

From G. P. Putnam's Sons, New York:  
Physical Geography, by John Young. New York, 1874.

From L. Y. Schermerhorn, C. E., Chicago, Ill.:

Matter referring to the Improvement of the Illinois River, as follows:

Specifications of the Manner of constructing a Dam and a Lock at Copperas Creek. 1873. 2 papers.

Description of a Dam and Lock at Henry, Ill., with 2 photographs and 1 plate.

Report of the Canal Commissioners of Illinois, December 1, 1872. Springfield.

From William P. Shinn, C. E., Pittsburgh, Pa.:

Reports of the General Freight Agent of the Pittsburgh, Fort Wayne and Chicago R. R., for 1865 and 1868. Pittsburgh, 1868.

From T. Guilford Smith, C.E., Buffalo, N. Y.:

Report of the President and Managers of the Philadelphia & Reading R. R. Co., January 12, 1874. Philadelphia.

From Messrs. Speilmann & Brush, Hoboken, N. J.:

Report of the North Hudson Co. Water Commissioners on the proposed new Water Works, for Hoboken, Weehawken, West Hoboken, and Town of Union, N. J., 1873. Hoboken. (2 copies.)

From the Society of Engineers and Architects of Austria:

A History of the Foundation of the Society—its Rules, &c., and an Account of the Celebration of its 25th Anniversary. Vienna, 1873. (German.)

Journal of the Society. Vienna, 1873. (German.)

From P. E. Wilken, Esq., New York:  
Furnace for Bending Boiler Plates. A Drawing.

#### BY PURCHASE.

Specifications and Drawings of Patents issued from the U. S. Patent Office, for August and September, 1873. Washington. 2 volumes.

## ANNOUNCEMENTS.

**MEETINGS.**—The next evening meeting of the Society will be held Wednesday, March 18th, at 8 o'clock p. m.

"Tests of materials, used in construction, and testing machines," the subject of consideration January 21st, will be again taken up. Mr. Macdonald's paper "Proportions of the heads of eye-bars." Mr. Richard's paper "Experiments on the tensile strength of bar iron and boiler plate," (February Transactions) and others referring to the general topic will be discussed. Members who have

not done so, are requested to communicate what information of general interest they possess relating to either of the heads specified in a previous announcement of this subject, (Proceedings, p. 58).

It is expected that a paper on the "Approximate value of a reduction of maximum grade, especially for the use of locating engineers," will then be presented, to be discussed with Mr. Crosby's paper on the "Economy of railroad curvature." (February Transactions).

The next stated meeting of the Board of Direction will be held on Monday, March 30th, at 2 o'clock P. M., when a detailed plan for the next Annual Convention will be presented by the Committee of the Board, appointed March 2d.

The next afternoon meeting of the Society will be held Wednesday, April 1st, at 1 o'clock P. M., when ballots for members will be canvassed, and Prof. Thurston's paper on the "Resistance and physical properties of materials" (herewith published) will be discussed. It is expected that the paper previously announced, noting "Experiments on the proportion which the flow of streams bears to the rainfall" will then be presented.

At the evening meeting of the Society, to be held April 15th, "Elements of cost of railroad traffic"—the subject of consideration February 18th, will again be taken up; Mr. Chanute's paper on the "Elements of cost of freight transportation" (herewith published), and data then presented in response to the circulars issued, (Proceedings, page 58)—asking from railroad managers and others, detailed information as to the several items of cost determined or observed by them, will be discussed. Facts showing the comparative effect of passenger and freight trains upon the track and road bed, or references to where such are recorded, are desired.

At the afternoon meeting of the Society, to be held May 6th, it is expected that the paper on "Strains in draw-bridge spans and turntables, and giving co-efficients of rolling friction as determined by experiment" previously announced, will be presented.

**THE NORMAN MEDAL.**—By order of the Board of Direction, announcement is made that papers in competition for this prize of merit will be received, as follows:

The writers shall be members of the Society in one of its several classes; the papers shall be of practical engineering interest, and not of a purely speculative or theoretical character; they shall be presented within two months prior to the Annual Meeting (or by September 4th), be headed with the title, but not exhibit the writer's name in any part of the manuscript; and with a sealed envelope superscribed with the title, and containing the title and writer's name, be enclosed in one packet, which shall be addressed to the President of the Society, and endorsed "For the Norman Medal, 1874." No paper otherwise presented or in possession of the Society will be admitted to competition.

The papers will be examined without knowledge of the writers' names, by a Board of Censors; the award will be declared at the Annual Meeting; and the medal (of cost equal to the yearly interest upon \$1,000 N. Y. Croton Aqueduct Stock) will be delivered to the successful competitor, before January 4th, 1875.

**IRON AND STEEL RAILS.**—The Committee appointed to determine the best form of standard rail sections for the railroads of this country; the proportion which the weight of rails should bear to the maximum loads carried on a single pair of wheels of locomotives or cars; the best methods of manufacturing and testing rails; the endurance, or as it is called, the "life" of rails; the causes of the breaking of rails in use, and the most effective way of preventing it; and the experience of railways in this country in the use of steel rails—have issued a schedule of interrogatories to members and others, with the request that the answers be returned to the Committee by April 1st, next. To elicit both specific and general experience, the interrogatories are divided into two parts; 1st, data; 2d, opinions and conclusions. It may be that parties having no data at hand, will be enabled nevertheless to send very valuable suggestions. The returns are therefore separated, so that either or both may be used. The circulars will be furnished on request, and the Committee will take great pleasure in forwarding their report to those who contribute information therefor.

**COMMENTS AND DISCUSSIONS.**—On the papers published in "Transactions," are solicited from members, whether present at the meetings of the Society or not. They are urged to contribute selections from their note-books and other similar recorded experience, bearing upon the subjects considered; those seeking information are asked to suggest professional topics for discussion.

**PHOTOGRAPHS OF MEMBERS.**—By resolution of the Society, each member has been requested to furnish two photographs of himself, of the usual card size, as a means of promoting social recognition and intercourse. Those who have not complied with this request are specially asked to aid in making the collection complete, by speedily forwarding their photographs, endorsed with autograph and date.

Rather than separate the Papers contained in this number of Transactions, or delay their publication, the Committee on Library determined to add 12 pages, to be taken from the April number.

# AMERICAN SOCIETY OF CIVIL ENGINEERS.

## PROCEEDINGS.

### MINUTES OF MEETINGS.

(Abstract of such as may be of general interest to members.)

#### OF THE SOCIETY.

MARCH 18TH, 1874.—A stated meeting was held at 8 o'clock p. m.

A paper\* by John G. Clarke, C. E., on the "Approximate Value of a Reduction of Ruling or Maximum Grades" was read and briefly discussed.

The subject "Tests of Materials used in Construction and Testing Machines," considered at the stated meeting, held January 21st, was again taken up. O. Chanute, C. E., presented a report made by Russell H. Curtis, C. E., on "Tests of Eye-Bars for Iron Bridges on the Erie Railway," which was read, and a discussion followed.

APRIL 1ST, 1874.—A regular meeting was held at 1½ o'clock p. m.

The vote upon admission to membership was canvassed, and the following declared elected: Members, John M. Brown, C. E., of Auburn, N. Y., Abraham B. Cox, Jr., C. E., of Rochester, N. Y., Gen. William B. Franklin, of Hartford, Conn., William F. Merrill, C. E., of Buffalo, N. Y., Charles R. Schott, Jr., C. E., of New York, Joseph S. Smith, C. E., of Philadelphia, Pa., R. Willard Ware, C. E., of Port Jervis, N. Y., and Joseph Wood, C. E., of Washington, D. C.; and Juniors, Joseph B. Davis, C. E., of Ann Arbor, Mich., David Reeves, C. E., of Philadelphia, Pa., and Samuel Whinery, C. E., of Butlerville, Ind. The resignation, on March 12th, of H. L. Koons, C. E., Associate, of Los Angeles, Cal., was announced.

A paper by Prof. Robert H. Thurston on the "Strength, Ductility and Resilience of Materials of Machine Construction," a communication from Edward Turner, C. E., referring to the "Elements of Cost of Railroad Traffic," and one from Gorham P. Low, Jr., C. E., suggesting measures for making a comparative examination of the principal pumping engines in use, were read. The latter was referred for consideration and report to a committee consisting of Messrs. Gorham P. Low, Jr., John Bogart, W. Milnor Roberts and William E. Worthen.

\* Transactions, page 399.

The expediency of a change in location of the rooms of the Society was referred to Messrs. John Bogart, Francis Collingwood and G. Leverich, as a committee to obtain requisite information, and report to the Board of Direction, which was empowered to act in the matter.

### OF THE BOARD OF DIRECTION.

MARCH 30TH, 1874.—A stated meeting was held at 2 o'clock P. M., and proposals for admission to the Society were considered.

A report\* from the committee appointed to prepare a detailed plan for the Sixth Annual Convention of the Society, to be held in New York, June 10th and 11th, was adopted; the Committee on Library was requested to present a scheme for the division of the books, maps and similar property of the Society, into works of reference which shall not be removed from its rooms, and works which may be loaned to members—and the Secretary was instructed to send a circular to members of the Society and to managers of public works generally, asking the donation of new and old reports, odd pamphlets and similar matter, which may furnish a basis for the history and comparison of engineering operations.

### CODE OF RULES

FOR THE

### AWARD OF THE NORMAN MEDAL.

The Committee appointed "to arrange with George H. Norman, Esq., the details necessary to perfect his plan" to award a medal each year for the best essay on engineering subjects, has conferred with the donor of the fund, and reported the following plan or Code of Rules to be observed in awarding the "Norman Medal of the American Society of Civil Engineers."

I. Competition for the Norman Medal of the American Society of Civil Engineers shall be restricted to members of the Society.

II. There shall be one gold medal, and only one, struck for each and every fiscal year of the Society, and awarded as hereinafter provided. The dies therefor shall be deposited with the superintendent of the United States mint at Philadelphia, in trust exclusively for the aforesaid purpose. Such medal shall be of a cost equal to the annual interest received upon \$1,000 of the consolidated stock of the city of New York, certificate No. 179, of additional new Croton Aqueduct stock of the city of New York, authorized by an act of the Legislature of the State of New

\* For an abstract of this, see Announcements, page 83.



York, Chap. 230, passed April 15th, 1870, dated November 17th, 1873; now held in trust by the Treasurer of this Society, and so held solely for this purpose; and shall be executed upon his order.

III. The President of the Society, the President of Columbia College, and the Engineer Officer of the United States Army commanding in that capacity in New York city and vicinity, shall be, ex-officio, a Board of Censors, whose duty it shall be to examine all papers entitled to competition under these rules, and award the Norman Medal as a prize of merit, as hereinafter provided.

IV. No papers shall be entitled to competition except such as are of practical engineering interest; it being the expressed intention of the donor to exclude from competition all papers of a purely speculative or theoretical character.

V. Each paper submitted for competition shall be headed with the title, but shall not exhibit the author's name on any part of the manuscript; it shall be accompanied with a sealed envelope, superscribed with the title, and enclosing both the title and the name of the author. The whole to be enclosed in an envelope addressed to "The President of the American Society of Civil Engineers," and conspicuously endorsed "For Norman Medal, year.....;" and presented at least two months prior to the Annual Meeting; and no paper otherwise presented, or in possession of the Society, shall be admitted to competition, nor except for the fiscal year in which it shall have been presented.

VI. All papers presented in accordance with the foregoing rule shall first be submitted by the President to the Board of Censors; and after their examination, and at the Annual Meeting, the President shall present the successful essay, together with the sealed envelope containing the author's name, accompanied with the certificate of the Board of Censors, to the Society—when the envelope shall be opened, the author's name announced, and the award declared. Such award shall be entered on the Minutes and published in the proceedings of the Annual Meeting. If for any reason, in any year, there shall be no award of this medal, then the amount of the interest of the fund for that year shall be expended by the Board of Direction in the purchase of books; said books to be offered as a premium for the second best competing paper for the medal of the succeeding year.

VII. The Treasurer of the Society shall cause the medal to be prepared and delivered to, or deposited to the order of the successful competitor, within two months after the Annual Meeting at which the same shall have been awarded.

VIII. The Board of Censors may make such regulations, consistent with this Code, as they may deem proper, and shall have power to fill vacancies in said Board.



## ENGINEERING AND TECHNOLOGY.

Under this head will be announced new books on these and kindred subjects in English, French and German, which may be professionally useful to members of the Society.

At the present rates of duty and exchange, the cost of imported books may be estimated in federal money, at one shilling equal to 50 cents, one franc to 37 cents, and one thaler to \$1.23.

- Architecture and Construction, Illustrated Review of—E. F. Le Preux. Paris (French). 8f.
- Annals of the Academic Society of Lyons. Lyons (French). 8vo, illus.
- Artillery, German, Operations of—in the Battles near Metz. From the official German Artillery Reports. Capt. Hoffbauer. Paris (French). Part I, with maps. 4ff.
- Memoirs on Marine Artillery—Minister of the Marine and the Colonies (exclusively for officers of the service). Paris (French) illus.
- Report on a Naval Mission to Europe, especially devoted to the Material and Construction of Artillery. By Capt. Edward Simpson, to the Secretary of Navy, Washington. 2 vols. 4to, illus.
- Bridge Building, Instructions on Modern American—with Practical Applications and Examples, Estimates of Quantities and valuable Tables. G. B. N. Tower. Boston. 8vo, illus. \$2.00.
- of Vichy, Memoir of the—M. Radoult de Lafosse, Engineer of Bridges and Highways. Paris (French). 8vo, illus. 5f.
- Bridges and Viaducts in Masonry. M. Debaux, Engineer of Bridges and Highways, Paris (French). 8vo, text, 4to, plates. 25f. (Forms the 10th number of the Manual of Bridges and Highways, to consist of 15 to 20 numbers.)
- Iron, Calculation of—M. de Montdésir. Ch. Engineer of Bridges and Highways. 2d ed. Paris (French). 4to, illus. 15f.
- Masonry, construction of—M. Decomble, Ch. Engineer of Bridges and Highways. Paris (French). 4to, illus. 12ff.
- Strains in continuous or connected Trusses of Iron Bridges. 2d ed. Edited by M. de Montdésir. Paris (French). 4to, illus. 15f.
- Buildings, Handbook on the Art of Constructing—(German). 8vo, illus. 4ff.
- Cannon. Record of the Trial of a Steel Breech-loading Cannon—30½ centimetres calibre. Fabricated by F. Krupp. Paris (French). 12mo, ff.
- Cast Iron and Steel. Strength and other Properties of—G. H. Love. Paris (French). 8vo, illus. 8ff.
- Use of—in Construction. M. A. Guettier. Paris (French). 8vo, text. 4to plates. 2 vol. 30f.
- Chemistry of the Carbon Compounds, A Manual of—or Organic Chemistry. C. Schorlemmer, F.R.S. London. 8vo, cloth. \$5.00.
- Civil Engineering, Annals of—a Collection of Memoirs on Bridges, Highways, Railroads, Navigation, Architecture, Mines, Metallurgy and General Technology. Edited by E. Lacroix, assisted by a number of Engineers and Professors. 2d series, vol. II. Paris (French). 8vo, text, atlas plates. 25f.
- Coal, Index to Report of Committee on Price of Coal. Parliamentary Report. London. 3d.
- Coal, Mechanical preparation of, etc. M. Pernolet. Paris (French). 8vo, illus. 3½f.
- Mines, Methods of Operation. M. Amyot. Paris (French). 8vo, illus. 7ff.
- Compass, Notes on the Regulation of—by observations of Horizontal Force. M. E. Caspari. Paris (French). 8vo.
- Protractor, Instructions on—especially designed for rapid Plotting of preliminary Surveys and military Reconnaissances. Frederic Hennequin. Paris (French). 12mo. ff.
- Constants of Nature. Part I. Specific Gravities—Boiling and Melting Points and Chemical Formula. Compiled by Frank Wigglesworth Clarke, S. B. (Smithsonian Miscellaneous Collection.) Washington. 8vo. \$1.25.
- Curves, Railroad—Tables for Locating. M. Gannin. Paris (French). 8vo. 7ff.
- Defenses, Construction and Application of Accessory Defenses. H. Girard, Capt. of Engineers, Belgian Army. 2d ed. Paris (French). 18mo, illus. 2ff.
- Dictionary of Art, Manufactures and Agriculture. Ch. Labouleye and Committee of Engineers. 4th ed., Vol. I. Paris (French). To consist of 4 vols., illus. Each 22f.
- , Technological, English—French. M. Burg. Paris (French). 32mo. 1f.
- Drainage of Towns, Watercourses, Drains and Irrigation. A. Ronna. Paris (French). 8vo, illus. 12f.
- Drills, Compressed Air—Experiments with, at Sarrebruck, Vieille-Montagne and Auzin. M. Pernolet. Paris (French). 8vo, illus. 5f.
- Dynamometer, Watt's indicating—With methods of Determining the Work of Steam Engines. A Practical Handbook. Albert Thomas. Paris (French). 8vo, illus. 3ff.
- Earth, Dynamical Theory of the Formation of—A. T. Ritchie. 3d ed. London. 8vo. \$5.00.
- Earthwork for Railway Construction, Tables of—L. Ponzzer (German). 8vo. 2ff.
- Electricity, A Treatise on the Mathematical Theories of—as developed by Ampère, Neumann, Weber and Kirchhoff. Part I. Leipzig (German). 8vo. 7s. 6d.
- Elevations, Dictionary of—and climatic Register of the United States. Containing, in Addition to Elevations, the Latitude, mean annual Temperature and the total annual Rainfall of many Localities. J. M. Toner, M.D. New York. 8vo. \$3.75.
- Engineers, Society of—Transactions for 1871 (Contents).—I. Machinery and Utensils of a Brewery. Thos. Wilkins. III. Brewing Apparatus. John Walker. III. Ventilation of Sewers. Baldwin Latham. IV. Timbering of Trenches and Tunnels. Charles Turner. V. Recent Improvements on Explosive Compounds. P. F. Nursey. VI. Floating Breakwaters. Thos. Cargill. London. 8vo. \$4.25.
- Fortifications, A Treatise on the Iron Plating of—E. Von Glanz. Vienna (German). 8vo. 2ff.

- Fortifications of the Future, Essay on**—E. Wagner. Paris (French). 1f.
- of the German Armies around Paris. 4th Part, from the Valley of the Bièvre to the Valley of Sèvres. Paris (French). 8vo text, 40 plates. 5f.
- Fuel.** W. C. Siemens; and the Value of artificial Fuels as compared with Coal. John Wornahl. New York. 18mo. \$0.50.
- Geologic Notes on Chili.** M. M. Maillard and Fuchs. Paris (French). 8vo, illus. 2f.
- Geology of the Chain of the Andes, from the 16° to 53° S. Latitude.** M. Pissis. Paris (French). 8vo, illus. 4f.
- Gun Metal.** E. Frémy. Clichy (French). 8vo.
- Harbors, Design and Construction of**—A Treatise on Maritime Engineering. 2d ed. Edinburgh. 8vo. 15s.
- History of the Professions, Trades and Inventions of Austria, from the Middle of the 18th Century to the Present.** Edited by Prof. W. F. Exner. 1st Series. Raw Productions and Manufactures. Vienna (German). 8vo. 3½t.
- Horse Railroads and Tramways, A Practical Treatise on the Construction of**—M. Le Comte d'Adhémar. Paris (French). 8vo, illus. 6f.
- Humboldt, Special Atlas to Works of**—24 Maps prepared by Humboldt, or under his direction. Paris (French), in portfolio. 70f.
- Hydraulics, Description of different Forms of Apparatus for raising Water, hydraulic Motors, etc.** Chauveaux des Roches, Bélin and Vigreux. (French.) 8vo text, 4to plates; (correction of title on page 63).
- Hydrographic Annals**—Minister of the Navy. Relating to Hydrography and Navigation. A quarterly Publication. Paris (French). illus. Yearly 16f.
- Hydrological Studies on the Jura Mountains.** M. Lamaisse. Paris (French). 4to, text, atlas, plates. 20f.
- Inland Navigation, A Treatise on the Navigation of large Streams, on Quays, Dams, Towage, &c.** M. de Lagréné. Paris (French). 4to text, atlas plates. 6 vol. 75f.
- Iron and Coal, New Studies on Manufacturing Processes.** Louis Reybaud. Paris (French). 8vo. 7½t.
- **Ore, Apparatus for the Treatment of Iron Ore by means of any Fuel, as Coal Slack, Sawdust, Peat, &c.** Paul Poirier. Nantes (French). illus.
- Lead and Zinc Ores, Smelting of**—in Belgium and Rhenish Prussia. M. Henry. Paris (French). 8vo, illus. 7½f.
- **Smelting of at Psibram.** M. Henry. Paris (French). 8vo, illus. 5f.
- Locomotion, Handbook of**—including the Construction, Running and Management of Locomotive Engines and Boilers. Stephen Roper. Philadelphia. 12mo, illus.
- Machines, Description of the most remarkable and novel**—at the Vienna Exposition of 1873. M. Fontaine. Paris (French). 8vo, text. Folio plates. 35f.
- Mechanical Engineers, Institution of**—Proceedings, May 1st, 1873. Birmingham. 8vo.
- Memoirs of the Academy of Science and of the Institute.** Paris (French) 4to, illus.
- Metalliferous Veins of Psibram, Studies on.** M. M. Levy and Chonlette. Paris (French). 8vo, illus. 4½f.
- of Saxony and Northern Bohemia, Studies on. M. M. Levy and Chonlette. Paris (French). 8vo, illus. 7½f.
- of Schemnitz, Study of—With a Notice of the School of Schemnitz. M. M. Henry and Zeiller. Paris (French). 8vo, illus. 7½f.
- Metalurgy, a Manual of**—Vol. I. Fuel, Iron, Steel, Tin, Antimony, Arsenic, Bismuth and Platinum. London. 12mo, illus. 2s. 6d.
- Metals, Researches on the electrical Resistance of Metals and their Variations under the Influence of Temperature. Suggestions made by the Faculty.** R. Benoit. Paris (French). 4to. 1½t.
- **Tables of the Weights of**—M. Jacquet. Paris (French). 8vo. 4½f.
- Ornamentor, The modern Ornamentor and interior Decorator.** A. P. Boyce. Boston. 4to, illus. \$3.50.
- Projectiles, Trial of the Movements of oblong**—(French.) 8vo. 1½f.
- Quadrature of the Circle, Containing Demonstrations of the Errors of Geometers in finding the Approximations in Use, with an Appendix and Lectures on polar Magnetism and the Non-Existence of projectile Forces in Nature.** John A. Parker. New York. 8vo. \$2.50.
- Quaternions, An Elementary Treatise on**—P. G. Tait, M. A. New ed. London. 8vo. \$7.00
- Railroads, Construction and Destruction of**—in time of War. Lieut. M. Wibrotte. 2d ed. Paris. (French.) 8vo, illus. 1½f.
- **in La Meurthe, Local Traffic for**—M. Varroy. Paris. (French.) 8vo, illus. 4½f.
- **Military ideas concerning the Italian**—Carlo Aymonino. Tours. (French) 12mo.
- **Studies on Switches and Connections.** Ch. Richoux. (French.) 8vo, text, folio plates.
- Resistance of Materials, Treatise on**—V. D. Develshauvers. Liege (German). 8vo, illust. 5f.
- Sailor's Pocket-Book: A Collection of practical Rules, Notes and Tables for Use of the Royal Navy, the mercantile Marine, and Yacht Squadrons.** Portsea. 16mo, illus. 7s. 6d.
- Sands, Studies on a special Property of and on its Application.** L. A. Beaudemoulin. Paris. (French.) 8vo, illus. 2f.
- Steam, An Elementary Treatise on**—John Perry, B. E. London. 16mo, cloth, illus. \$1.50.
- **Engine, The Slide Valve practically Considered.** 5th ed. London. 8vo. 5s.
- **Generators, Heat a source of Power; with Applications of general Principles to the Construction of steam Generators. An Introduction to the Study of heat Engines.** William P. Trowbridge, Prof. of Dynamic Engineering, Yale College. New York. 8vo, \$3.50.
- Steel, Bessemer, Manufacture of**—M. Janoyer. Paris (French). 8vo illus. 3f.
- Surveying, A Treatise on the Method of Government Surveying as prescribed by the United States Congress and Commissioner of the General Land Office, with complete mathematical, astronomical, and practical Instructions, for the use of United States Surveyors in the Field, and Students who contemplate engaging in the business of public land Surveying.** Shobal V. Clevenger, Deputy Surveyor. New York. 18mo, tucks, \$2.50.
- Tables and Formula. A Pocket-Book of useful Tables and Formula for marine Engineers.** Frank Proctor. London. 32 mo, oblong.
- Technology.** Knapp's Chemical—Translated

from the German and enlarged by M. M. Debize and Mériot. Vol. I, 2d part. Paris (French). 8vo, illus. 9f.  
 Telegraphic Almanac. Paris (French). 32mo, 3f.  
 Telegraph, Hughes, Album of—22 Plates, with explanatory Text. G. Mirill. Brest (French). 4to. 8f.  
 Textile Fabrics. Reports from Secretaries of Embassy, &c., respecting Factories for the Spinning and Weaving of Textile Fabrics Abroad. Part I. Parliamentary Report. London. 8vo. 3s. 2d.  
 Transportation, Method of—used in Mines, Factories and Public Works. Alfred Eveara. Part III. Paris (French). 8vo, illus. 25f. (Complete in 4 Parts, forming 2 Vols. and Folio Atlas of Plates.)  
 Vienna Exposition and the Philadelphia Cen-

tennial. Report of Charles Francis Adams, Jr., Massachusetts's Commissioner. Boston. 8vo.

—Scientific Productions at the—Vienna (German). Part I. 8vo. 4s.  
 War. Franco-German. The Campaign of 1870-71. Operations of the 1st Bavarian Army Corps under General Von Der Tann. Compiled from the Bavarian Official Records. By Capt. Hugo Helorg. Trans. by Capt. G. S. Schwabe. London. 8vo, illus. 2 vols. 24s.  
 —Operations of the Corps of German Engineers. Ad. Goetze. Trans. from the German by Grillon and Fritsch. (French.) 8vo, illus. 7f.  
 Year Book of Art, Science and Military Technology. Edited by Major P. Henard, of the Belgian Artillery. (French.) 18mo. 7½f.

## LIBRARY AND MUSEUM.

### ADDITIONS IN MARCH, 1874.

NOTE.—Members and others are asked to contribute regularly to the library of the Society, copies of government, municipal, railway, canal and other reports, specifications, profiles, maps, photographs and like matter, making up the record of engineering operations for the past or present, and to inform the Secretary where such may be had. Duplicate copies are desired, for transmission to foreign societies in return for works collected and sent to this library by them; also for exchange with members and others who wish complete sets referring to particular subjects. In order to gather material now considered of but little value, but of great future importance in the history of the public works of this country and a comparison of their economical results, donations are solicited of old reports or pamphlets, which in any way refer to their construction or operation.

### DONATIONS ARE ACKNOWLEDGED AS FOLLOWS :

From Gen. J. G. Barnard, New York :  
 Letter from the Secretary of War in Answer to a Resolution of the House, of March 14th, 1871, in Relation to a Ship-canal to connect the Mississippi River with the Gulf of Mexico. Washington, 1874.

—Transmitting a Report of the Board of Engineers relative to the Practicability of Bridging the Channels between Lake Huron and Lake Erie. Washington, 1874.

From A. S. Barnes & Co., New York :  
 The International Review. March, 1874. New York.

From Leonard F. Beckwith, C. E., New York :  
 The Fire-Proof Building Company of New York. 1874.

From A. D. Briggs, Esq., Springfield, Mass. :  
 Fifth Annual Report of the Board of Railroad Commissioners. January, 1874. Boston.

From J. G. Chase, C. E., Cambridge, Mass. :  
 City of Cambridge. Annual Report of the City Engineer to the City Council, for year ending Nov. 30th, 1873. Cambridge, 1874.

—Mayor's Address at the Organization of the City Government, and the Annual Reports made to the City Council. Cambridge, 1874.

—Ninth Annual Report of the Cambridge

Water Board to the City Council, with Reports, Documents, &c., for 1873. Cambridge, 1874.

From H. Wadsworth Clarke, C. E., Syracuse, N. Y. :  
 Annual Report of the Superintendent of the Onondaga Salt Springs. January, 1874. Albany.

Map of New York, Richmond, Queens and Kings Counties

From Messrs. Claxton, Remsen & Hefelinger, Philadelphia :  
 A new Method of Calculating the cubic Contents of Excavations and Embankments by the aid of Diagrams, together with Directions for Estimating the Cost of Earth-work. John C. Trautwine, C. E. Philadelphia, 1874.

The Field Practice of Laying out Circular Curves for Railroads. John C. Trautwine, C. E. Philadelphia, 1874.

From James Emerson, C. E., Holyoke, Mass. :  
 Fifth Annual Report of Turbine Tests. James Emerson, C. E. Springfield, Mass., 1874. (3 copies.)

From Col. John T. Fanning, Manchester, N. H. :  
 Manchester Water Works. Second Annual Report of the Board of Water Commissioners and Engineer, for 1873. Manchester.

From Charles E. Fowler, C. E., New Haven, Conn.  
City Year Book of the City of New Haven for 1872-3. New Haven, 1874. (2 copies.)

From Charles Douglas Fox, C. E., London, England:  
Report to the Commissioners of Sewers of the City of London on Accidents to Horses on Carriageway Pavements. Wm. Haywood. London, 1873.

From the Institution of Mechanical Engineers, Birmingham, England:  
Proceedings, May 1st, 1873. Birmingham.  
— 29th and 30th July, 1873. Cornwall Meeting. Part II. Birmingham.

From the Iron and Steel Institute, London, England:  
Journal of the Iron and Steel Institute. January, 1872, to April, 1873. London, 1872-3. (6 vols.)

From Col. W. E. Merrill, Cincinnati, O.:  
Letter from the Secretary of War relative to the Improvement of the Ohio River. Washington, 1874.

From Macmillan & Co. New York:  
Elementary Treatise on Steam. John Perry, B. E. London, 1874.

From Charles Paine, C. E., Cleveland, O.:  
Report of the Geological Survey of Ohio. Part I, Geology. Part II, Palaeontology. With Maps. 3 vols.

From the Publishers:  
German Building Gazette, the Organ of the German architectural and engineering Societies. Editors K. E. O. Fritsch and F. W. Busing. (German). Semi-weekly. Berlin.

From Admiral B. F. Sands, Washington, D. C.:  
Astronomical and Meteorological Observations made during 1871, at the U. S. Naval Observatory. Washington, 1873.

From Col. Thomas S. Sedgwick, Washington, D. C.:  
Report of Board of Internal Improvement on the Chesapeake and Ohio Canal to Chief Eng. Maj.-Gen. Alex. Macomb, October 23d, 1826. Annapolis, 1873.

From Smithsonian Institution, Washington, D. C.:  
Check List of Publications of the Smithsonian Institution, July, 1872. Washington.

From E. & F. N. Spon, New York:  
Hydraulics of Great Rivers. The Parana, the Uruguay, and the La Plata Estuary. J. J. Revy. London, 1874.

From Joseph M. Wilson, C. E., Philadelphia, Pa.:  
Photographs and Lithographs of Designs for proposed Park Bridge over Sixth st. Washington, D. C.

— of Design for proposed R. R. Bridge over Delaware river at Trenton, N. J.  
BY PURCHASE.

Atlas of Maryland, Distr. of Columbia and the U. S. and Territories. Martenet, Walling and Gray. Baltimore, 1873.  
— of Massachusetts. Walling and Gray. 1871.

— of Michigan. H. F. Walling, C. E. Detroit.  
Topographical Atlas of Ohio and the U. S. Walling and Gray. Cincinnati, 1872.

## ANNOUNCEMENTS.

MEETINGS.—The next evening meeting of the Society will be held Wednesday, April 15th, at 8 o'clock p. m.

"Elements of cost of railroad traffic"—the subject of consideration February 18th, will again be taken up; Mr. Chanute's paper on the "Elements of cost of freight transportation" (March Transactions), and data then presented in response to the circular issued, (Proceedings, page 58)—asking from railroad managers and others, detailed information as to the several items of cost determined or observed by them, will be discussed.

The next stated meeting of the Board of Direction will be held on Monday, May 4th, at 2 o'clock p. m., for the transaction of regular business.

The next afternoon meeting of the Society will be held Wednesday, May 6th, at which it is expected that the papers previously announced, "Experiments on the proportion which the flow of streams bears to the rainfall" and "Strains in drawbridge spans and turntables" will be presented.

THE SIXTH ANNUAL CONVENTION of the Society will be convened in New York, Wednesday, June 10th, 1874. The plan therefor, prepared by the Committee of the Board of Direction, and adopted March 30th, is as follows:

Four days will be devoted to the Convention and attendant proceedings; it will be called to order at 10 o'clock a. m. of the first day, as a special meeting of the Society, for the reading of papers, submission of reports, discussion of professional subjects, and any recommendation for the future action of the Society—the session to continue throughout the day and evening.

At 10 o'clock a. m. of the second day (Thursday, June 11th), the Society will proceed in a body to Hoboken, N. J., upon the invitation of W. W. Shippen, Esq., to visit the Stevens Iron Clad Battery, the Stevens Institute of Technology, and such other points of interest as may be presented. At 2 o'clock p. m., a steamboat excursion will start on a tour of inspection to the new docks at the Battery, the East River Bridge, and the submarine

works at Hell Gate, reaching Harlem Bridge at 5½ o'clock P. M., and returning either by train over the line of the Fourth Avenue Improvement to the Grand Central Depot, arriving at 6 o'clock P. M., or by boat to a convenient point of landing on the East river—in time for the Annual Dinner at 8 o'clock P. M.

On the morning of the third day (Friday, June 12th), an excursion train will leave Hoboken, N. J., for Scranton and Wilkes Barre, by way of the Delaware, Lackawanna & Western R. R., to afford an opportunity of visiting the Wyoming coal basin; the party to remain over night at Wilkes Barre, and return on the fourth day (Saturday, June 13th) over the Broad Mountain, by way of the Lehigh Valley R. R. to the Switchbacks at Mauch Chunk, thence through Bethlehem and Easton to New York.

A general Committee of Arrangements was appointed with power to regulate the duties of sub-committees, fill vacancies, and assume a general control of all proceedings not included in the regular order of business of the Society, also sub-committees as follows: on Invitations, on Reception, on Local Arrangements, on Procuring Papers, on General Transportation, on the Wilkes Barre Excursion, and on Finance.

It is believed that the Transportation Committee can arrange with the leading lines for free transportation to and from New York, details of which, and the names of those constituting the several committees, will be announced in May Transactions.

Members are asked to present papers upon professional topics for the consideration of the Convention, to promptly inform the Secretary of the subjects to be treated, the probable length of the papers, and who will attend the Convention.

The manuscripts should be placed with the Committee on Library at an early day—before June 1st if practicable—that such arrangements may be made for printing as will facilitate a ready and intelligent discussion. Diagrams and illustrations should be drawn to a scale so as to be plainly seen from all parts of the assembly room.

**IRON AND STEEL RAILS.**—Those to whom Circulars relating to the form, weight, manufacture and life of iron and steel rails, were sent, who have not responded, and who possess information on this subject which will aid the Committee in making a Report, are requested to forward replies at their early convenience, without regard to the time first named.

**COMMENTS AND DISCUSSIONS.**—On the papers published in "Transactions," are solicited from members, whether present at the meetings of the Society or not. They are urged to contribute selections from their note-books and other similar recorded experience, bearing upon the subjects considered; those seeking information are asked to suggest professional topics for discussion.

**PHOTOGRAPHS OF MEMBERS.**—By resolution of the Society, each member has been requested to furnish two photographs of himself, of the usual card size, as a means of promoting social recognition and intercourse. Those who have not complied with this request are specially asked to aid in making the collection complete, by speedily forwarding their photographs, endorsed with autograph and date.

Rather than separate the Papers contained in March Transactions, or delay their publication, the Committee on Library determined to add 12 pages, taken from this number.

#### ADMISSIONS TO THE SOCIETY.

April	7th,	1874.	BROWN, JOHN M.	Auburn, N. Y.
March	17th,	"	COOPER, THEODORE	Cooper's Plains, N. Y.
Feb.	16th,	"	FROST, E. D.	New Orleans, La.
March	21st,	"	HARLOW, JAMES H.	Pittsburgh, Pa.
"	9th,	"	KNAPP, LOUIS H.	Buffalo, N. Y.
Feb.	16th,	"	MORRIS, ROBERT C.	Nashville, Tenn.
March	9th,	"	PETTIT, HENRY	Philadelphia, Pa.
"	"	"	STAHLBERG, ALBERT J. (J.)	Waterbury, Conn.
April	4th,	"	WARE, R. WILLARD	Port Jervis, N. Y.

# AMERICAN SOCIETY OF CIVIL ENGINEERS.

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## PROCEEDINGS.

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### MINUTES OF MEETINGS.

(Abstract of such as may be of general interest to members.)

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#### OF THE SOCIETY.

APRIL 15TH, 1874.—A stated meeting was held at 8 o'clock P. M.

Communications from Hon. William J. McAlpine, giving a record of "Experiments on Mixtures of Mortars and Concretes,"\* and upon the power of earth to sustain foundations,† were read and briefly discussed.

The death, on April 1st, of John B. Rogers, C. E., late of St. Louis, Mo., and Member of the Society, was announced; and Messrs. C. Shaler Smith, Thomas J. Whitman and Walter Katté, were appointed a committee to present a fit memorial of the deceased.

A communication from Prof. Henry Morton, President of the Stevens Institute of Technology, relating to the founding of a "Testing Laboratory," for making complete and impartial tests of the characteristics, value and strength of materials used in the arts, was presented and referred for consideration and report to a committee consisting of Messrs. Octave Chanute, Alfred P. Boller and Richard H. Buel.

A paper by Col. W. Milnor Roberts, in review of Revy's "Hydraulics of Great Rivers," was read, and the subject as referring to the improvement of the mouth of the Mississippi discussed by Messrs. Chanute, Thurston and others.

MAY 6TH, 1874.—A regular meeting was held at 1 o'clock P. M.

The vote on admission to membership was canvassed, and the following declared elected: Members, Charles E. Emery, M. E., of New York; John A. Judson, C. E., of Newport, R. I.; Otho E. Michaelis, Capt. Ordnance U. S. A., of Pittsburgh, Pa.; Robert M. Newman, C. E., of New York, and Edward S. Philbrick, C. E., of Boston, Mass., and Junior, Russell H. Curtis, C. E., of New York. The death on April 16th, of Jonathan Camp, Jr., C. E., late of Jersey City, N. J., and Member of the Society was announced, and Messrs. Andrew J. Post, Charles Macdonald and Arthur Spielmann, were appointed a committee to present a fit memorial of the deceased.

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\* Page 87. † Page 88.



A paper by J. James R. Croes, C. E., on the "Flow of the West Branch of the Croton River," and referring to the relation between the flow and the rain fall, was read. Remarks on certain views contained in Revy's "Hydraulics of Great Rivers," and on the proposed improvements of the mouth of the Mississippi, were made by Col. W. Milnor Roberts and Gen. Theodore G. Ellis.

A report from the committee appointed February 18th,\* to consider the "Memorial of the American Metrological Society" was read, discussed and laid on the table; and one from the committee appointed February 4th,† to which was referred a communication asking the Society to declare what should be the course of instruction in schools and colleges, for students of engineering, was read and adopted.

#### OF THE BOARD OF DIRECTION.

MAY 4TH, 1874.—A stated meeting was held at 2 o'clock P. M.

Proposals for admission to the Society were considered, and the President, Secretary and Chairman of Committee on Finance were appointed a Committee on Applications, to whom all proposals for Membership shall be referred for examination and report to the Board with such recommendations as the committee may deem proper.

The Treasurer presented his semi-annual report on the finances of the Society, which was accepted, and referred to the Committee on Finance.

The committee appointed April 1st,‡ to consider the expediency of a change in location of the rooms of the Society, presented a report which was accepted.

Messrs. John Bogart, W. Milnor Roberts, Charles Macdonald, Francis Collingwood and Theodore Weston, were made a Committee on Rooms, to confer with kindred associations in New York, select chambers in a central location after the existing lease expires, and report to the Board. Members opposed to a change of place are requested to state their reasons therefor.

#### ABSTRACT OF THE REPORT

OF THE

#### COMMITTEE ON ROOMS.

The chambers of the Society are used as an assembly room where the meetings are held, a place where the Library is deposited, a reading room where books and papers may be consulted, and a store-room where duplicate books and pamphlets, copies of Transactions on hand, unbound papers and similar property of the Society may be preserved.

The requirements for these uses are essentially different. The assembly room for public meetings should be large enough to provide for the increasing attendance on the Society's meetings, and so arranged that all present can see and hear. For meetings of the Board of Direction and of committees, a smaller room is needed, devoted especially

\* Page 67. † Page 59. ‡ Page 78.



to this use and secure from intrusion. For library and reading rooms, large wall space, with an abundance of light is required:—in the first, quiet should be maintained, and convenience provided for study without interruption. In the store-room also work may be done connected with the Society, but not directly relating to members—as the preparation and mailing of Transactions, printing of circulars, or the cataloguing of the Library, and especially that which causes litter and dust.

These rooms should be contiguous, and each accessible without interference with the others:—they should be located so as to be easily reached by a large proportion of the resident membership. It is desirable that they be in a fire-proof building, and where there is an elevator.

The rooms now occupied do not fulfill these conditions in many respects. For library purposes they answer quite well, but there is not space for the large and regular accession of books, pamphlets, &c., now being received. From the surroundings, quiet and seclusion so agreeable to students of a library of reference, are quite out of the question: they are also unpleasant to visit at night, and that they are not fire-proof, the late fire which came so near causing severe loss, clearly showed.

The location of the rooms of the Society is an important matter. A canvass of the resident members with reference to their places of business and residence, will show that, during the day, Broadway and Chambers street, is not far from central; while, at night, near to Union or Madison Square would be most convenient to a large majority. During the last three winters, attendance at the even-

ing meetings has been greater than at those held in the afternoon, and it is relatively increasing. There is also at the evening meetings much more time for deliberation and discussion, and freedom from haste, than at the other meetings; and if the rooms were nearer central, the attendance would be much greater. In time, doubtless, it will be found advisable to open the rooms and library in the evening for the accommodation of members engaged during the day. This would render a central location still more desirable. The Committee took no steps under the resolution of the Board for removal at this time. With a view to learn the probable cost of rooms which would be suitable for the purposes of the Society, several buildings, new, practically fire-proof, with elevator and modern improvements, and eligibly located, were visited. Satisfactory quarters for a term of years can readily be obtained at a cost not much greater than now.

It was suggested that the Society lease for a term of years a dwelling near Broadway, fit it up—a part for the Society rooms, and the remainder as offices for engineers and architects. Again it was proposed that the Society unite with one or more kindred associations in this city, and either take a whole building, or chambers adjacent, so that, for instance, the assembly room could be used in common. In conclusion, it was recommended that a committee of five be appointed to confer with kindred associations, select rooms in a central location for the society after the present lease has expired, and report to the Board for its information—and that members opposed to a change of location be requested to present their reasons therefor.

## NOTES AND MEMORANDA.

Members are desired to contribute selections from their note books and similar records of experience referring to engineering practice, and those seeking information are asked to suggest professional topics for discussion.

WILLIAM J. MCALPINE, C. E., contributes the following:

MIXTURES OF MORTARS AND CONCRETES. —This is a record of experiments made with certain samples of sand and cement, with a view to determine the minimum quantity of cement necessary for a compact and dense concrete.

A cubic foot of the Hudson River sand, dredged opposite and below Albany, after it had been thoroughly kiln-dried, weighed 104½ pounds.

The same sand thoroughly saturated, but allowed to drain off through the holes in the box for a few minutes, weighed 124½ pounds, and after it had drained 36 hours weighed 116½ pounds.

This quantity was then taken out, again thoroughly saturated and as much as possible put back in the cubic foot box—a cubic foot then weighed 106½ pounds.

Again, when water was added to the kiln-dried sand in the cubic foot box, it settled down to 0.9733 cubic feet = 0.0267 per

cent. contraction, say  $2\frac{3}{4}$  per cent., and the sand then contained within its own bulk 0.3213 cubic feet of spaces, equal to 32 per cent.

150 pounds of Onondaga hydraulic cement measured.....2.2025 cubic feet,  
and  $409\frac{1}{4}$  pounds of sand  
measured.....4.405

6.6075 cubic feet.

When these were mixed dry the mass measured in volume 6.3577 cubic feet or  $44\frac{1}{2}$  per cent. more than the sand alone measured; when mixed as mortar, with  $136\frac{1}{4}$  pounds of water, a volume of 5.6146 cubic feet was made; an increase of bulk over the sand alone of  $27\frac{1}{2}$  per cent.

By another experiment mortars made of cement, sand and water in parts by measurement, set forth in Table I, exceeded in volume that of the sand introduced as shown.

The bricks here used were from Peekskill, N. Y., all of them hard-burned (paviors), and measured on an average  $7.96 \times 3.525 \times 2.262$  inches = 63.46 cubic inches. There were generally about 20.08 brick used in a cubic foot of brick masonry. The mortar (as the wall was laid) formed  $27\frac{1}{2}$  per cent. of the masonry and the bricks  $72\frac{1}{2}$  per cent. When

TABLE I.

CEMENT.	SAND.	WATER.	% of excess.
100	100	72	70
100	150	93	$42\frac{1}{2}$
100	200	96	$26\frac{1}{2}$
100	300	127	$12\frac{1}{2}$

thoroughly kiln-dried for 48 hours these bricks weighed 4.14 pounds each, and after being soaked 24 hours weighed 4.73 pounds, an absorption of 17 per cent. Bricks of the same kind were broken up for concrete, and then a cubic foot of them absorbed into the pieces themselves, 0.144 cubic feet, or 9 pounds of water, and when thus saturated held 0.484 cubic feet or  $30\frac{1}{2}$  pounds of water in their interstices.

Concretes made of cement, sand, broken brick and water, per Table II, exceeded in volume that of the broken brick introduced, as shown; per cubic foot the cement weighed 68 pounds, the sand 80 pounds, and the broken brick 56 pounds.

TABLE II.

CEMENT.		SAND.		BROKEN BRICK.		WATER.	CONCRETE.	
Parts.	Cub. ft.	Parts.	Cub. ft.	Parts.	Cub. ft.	Cub. ft.	Cub. ft.	% of excess.
1	0.25	2	0.50	4	1.00	0.37	1.181	18
1	0.25	2	0.50	5	1.35	0.41	1.277	$27\frac{1}{2}$
1	0.25	2	0.50	6	1.50	0.45	1.532	$53\frac{1}{2}$

#### THE SUSTAINING POWER OF EARTH. —

Query. 7. What is the pressure, per square foot, at which settlement of a foundation will occur, on fine sand, whose natural slope is  $2\frac{1}{2}$  or 3 to 1, and what is the safe load on such at a depth of 5 or 6 feet below the surface? (Page 62.)

I have examined this problem without finding any record of American or European practice referring to it.

It will be necessary to specify the quality of the earth, and whether it is dry, moist, or saturated. Settlement must begin whenever any weight is applied; that is, all materials will be compressed under a load.

My experiments connected with the erection of the new State Capitol (at Albany, N. Y.) showed that in a pit 3 feet deep,  $3\frac{1}{2}$  feet square at the bottom, and  $3\frac{1}{2}$  feet at the top, in the stiff blue Albany clay, fully saturated

and containing 25 per cent. of its weight of water, the material was compressed until the load exceeded 2 tons per square foot, and then the particles were forced outward into and among the adjacent particles, compacting but not raising the surface of the earth adjoining. When the load was about 6 tons per square foot the adjoining earth was lifted, the frame sank on which the load was placed.

Therefore I conclude that this material fully saturated will safely sustain 2 tons per square foot with a settlement corresponding to the resistance of the earth to compression plus the lateral resistance of the adjacent earth to the displaced particles. This second resistance depends upon the weight of the surrounding earth, or in other words, the depth of the pit; it, however, is but a small part of the whole sustaining power of the material.

In the New State Capitol foundations the pit was enclosed by a deep puddle wall, and the clay underneath the walls covered with very porous coarse gravel (no fine being in it)—the object being to maintain in the earth underneath a constant and uniform degree of moisture or hydration for all time.

The load upon every part of this founda-

tion, when the building is finished, will be 2 tons per square foot of earth covered.

Members are asked to state what is their experience relative to the sustaining powers of any description of earth in a dry, moist or saturated condition, and to say where any printed information upon it may be found.

## BOOK NOTES.

**LAYING OUT RAILWAY CURVES.**—Two recent works clearly set forth the differences between American and English methods in this branch of engineering practice.

The first\* is a reprint of a former edition, somewhat enlarged and improved.

Among the additions may be noticed, a claim in the preface, that the present mode of laying out curves was first employed in this country in 1701, in tracing the northern boundary of the State of Delaware; that "Col. Stephen H. Long, U.S.A., was the first person who reduced it, by means of appropriate rules and tables, to the form now in general use," as seen in his "Railroad Manual," published in 1829, 14 years before Prof. Rankine published a similar method in England; and two tables in the book itself, one of "actual tangents (*i. e.* distances from the point of tangency to the apex), for a 1° curve, for different deflections of tangents, and one of middle ordinates for curving rails.

Also an addition to Article IX on changing the beginning of a curve, so that it may terminate properly in the second tangent, when as first run it would not; one to Article X, on changing the radius, so that the new curve shall end in a tangent parallel with the old one, and at a given distance from it, and one to Article XV, giving an exact rule for finding the radius from the chord and deflection angle.

Two new Articles—XIII. on commencing a curve with a chord of less than 100 feet, and XIV. "on the correction of compound curves," are given. His directions for the adjustment of the transit are improved, both in the language and illustrations.

The treatise ends with a chapter "On the Resistance of Curves," including the problems of flattening of grades on curves, equa-

tion for curvature and elevation of outer rail, with remarks on coning of wheels, performance of engines and equation of grades. In this, singularly enough, what has been written on the latter subject is condemned, while for the more intricate question of equation of curvature, at least an approximate solution is claimed.

The first 22 of the 147 pages of the second book\* are devoted to description and directions for the use of the succeeding tables.

The tables give evidence of great industry and ingenuity in their calculation and arrangement, which, however, conform to a practice in the use of curves that is not American, whatever else it may be. In the United States it is the custom of engineers to assume the length of chord and central angle, and from these data calculate such other sub-chords, lines and angles as may be needed. In this work the reverse is done—the length of arc and the radius being assumed and the other parts computed. As a consequence, the deflections and chords come out in fractions.

The object of this book appears to be to obviate the necessity of making these computations in the field, and for a list of radii and arcs the functions are given, so that by means of them curves can be laid out.

1st—in the usual method, by deflection angles and short chords;

2d—by deflection angles, long chords and offsets;

3d—by deflection angles, sub-tangents and offsets, and

4th—by deflection distances.

The tables are confined to the case of simple circular arcs, although the directions given for their use are sufficient to show how the curves, of given radii, may be compounded, but the book nowhere gives any

\* The field Practice of laying out circular Curves for Railroads, by John C. Trautwine, Civil Engineer. 9th ed. Philadelphia. Claxton, Remson & Haffelfinger, 1874.

\* "Tables for setting out Railway Curves, by David Livingstone, C. E." London, 1873. E. & F. N. Spon.

instructions from which a novice might calculate others or check these.

The work, viewed as a labor-saving compilation of tables for the cases and methods given, may be very useful, but it cannot be considered as anything more. When, as in this country, the central angle is taken so as to be expressed by some easily combined figures, as  $1^\circ$ ,  $2^\circ$ ,  $3^\circ$ , &c., or even by multiples of  $10'$  or  $15'$ , the labor of making the combinations requisite for the field work is but little, if any, more than that of looking up the appropriate table in these pages.

THE THEORY OF FRAMED STRUCTURES\* is the subject of a small volume (of about 90 pages) by the author of a "Treatise on Bracing" published in 1851. This work is not a reprint or revision of the former—it is divided into two parts, Part I. being devoted to a classification of structures, and Part II. to the application of Prof. Maxwell's method of forming diagrams of forces. It contains about 350 illustrations, giving outlines of almost every conceivable form of truss, with diagrams of the forces developed therein. The letter press is much condensed, and contain but little more than references to the figures. Elaborate discussion has been entirely avoided, much being left for the student to work out. The whole appears to be a preliminary study to a more elaborate practise.

STRENGTH OF BESSEMER STEEL.†—The steel produced by the Bessemer process at the "Waltzwerks and Bessemer Stahl Fabrications—Gesellschaft Pernitz" was recently examined and tested by Prof. Bauschinger, at the testing laboratory of the School of Technology at Munich, with the following results:

The specimens were found by analysis to contain from 0.14 to 0.96 per cent. carbon. In testing for tensile strength they were made 0.6 metres (25.622 in.) long, 0.075 x 0.012 metres (3 x 0.47 in.) in section, and reduced for a length between marks of 0.4 metre (15.748 in.) to a section of 0.070 x 0.012 metres (2.759 x 0.47 in.); they were tested in pairs taken from each plate.

For compression the specimens measured 9 x 3 x 3 centimetres (3.5433 x 1.1811 x 1.1811 in.), and 6 centimetres (2.3622 in.) between marks for comparison. Similar specimens were prepared for experiments on

\* Economics of Construction in relation to framed Structures. R. H. Bow, C. E. London, 1873. 8vo. E. & F. N. Spon.

† Versuche über die Festigkeit des Bessemer Stahles, etc.

elasticity by reducing them for a length of 2 centimetres (.7874 in.) to a rectangular section of similar length of side.

The shearing strength of specimens 15 centimetres (6 in.) long, and 7 x 1 centimetres (2.7559 x .3937 in.) section was measured, and many other specimens were subjected to other forms of strain.

In tension, the modulus of elasticity is very many constant for all grades—about 2,220,000 kilogrammes per square centimetre (31,586,000 lbs. per square in.)—and varying irregularly between approximate grades, frequently than between extremes. The elastic limit rises quite regularly from 2950 to somewhat above 4800 kilogrammes per square centimetre (42,000 to 68,300 lbs. per square in.), the difference between specimens of similar grades, which are imperceptible in the lower grades, rising in the highest as their hardness increases. The elongation as given ranges from 24 per cent. in the softest to 68 as the mean of the hardest. The ultimate resistance ranges from 4430 to 8305 kilogrammes per square centimetre (63,000 to 118,200 lbs. per square in.)

The area of breaking section, the most accurate indication of the ductility of the metal, is given in the average, at 50.8 per cent. of original section of the softest, and 90.05 in the hardest.

In compression, the modulus of elasticity varies irregularly and without any apparent connection with the proportion of carbon, ranging from 2,170,000 to 2,740,000 kilogrammes per square centimetre (30,875,000 to 38,985,000 lbs. per square in.). The elastic limit rises quite evenly from 2775 to 5000 kilogrammes per square centimetre (39,483 to 91,140 lbs. per square in.) as the percentage of carbon increases from 0.14 to 0.96 per cent.

In shearing the resistance rises gradually from 3400 to 5800 kilogrammes per square centimetre (48,400 to 82,500 lbs. per square in.).

ON WATCH WORK.\*—This little book is a compendium rather than a treatise. It is sufficiently full to give a good general idea of the subject, and was no doubt written with this intent; but it can in nowise take the place of the scientific works from which it draws so largely.

Those who are not familiar with the subject, will find this book very interesting, particularly the historical portion, which is quite full. Thus, the first pocket watches made

\* A Treatise on Watch Work, past and present. By Rev. H. L. Nelthropp, M. A., F. L. A. London, 1873. 8vo. E. & F. N. Spon.

in Nuremberg about 1500, were, from their shape, known as "Nuremberg eggs." The term "pinchbeck," now generally applied to an imitation gold case, came from the name of the manufacturer, Mr. Christopher Pinchbeck, who, in 1721, first made the alloy. This history is an illustration of the slow steps by which invention has successively overcome difficulties, and at last reached the perfection as seen in the mechanism of the best watches.

The description of the various escapements is tolerably full; we must dissent from the praise bestowed upon what is known as the "duplex" escapement; the least wear destroys its accuracy of adjustment, and spoils the watch for exact time-keeping. Sufficient prominence is not given to the lever or

anchor escapement, almost universally used, which, for durability and accurate time-keeping under all conditions, is the best extant—not excepting the chronometer escapement, which is only suited for use on ship-board. The chapters on adjustments of hairsprings, furnish information not easily reached elsewhere, and are quite complete.

The author is unjustly severe upon watch-makers as a class; no doubt there are charlatans and dishonest men among them, but not more than in other trades or professions. He gives sound advice to purchasers, when he says that instead of depending upon their own judgment in the selection of a watch, they should consult with a reliable and experienced dealer.

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#### NEW BOOKS ON

### ENGINEERING AND TECHNOLOGY.

Under this head will be announced new books on these and kindred subjects in English, French and German, which may be professionally useful to members of the Society.

The original titles of foreign books noted here will be furnished, on request.

At the present rates of duty and exchange, the cost of imported books may be estimated in federal money, at one shilling equal to 50 cents, one franc to 37 cents, and one thaler to \$1.23.

Architectural Studies; published by the Architectural Society, at the Royal "Polytechnicum" in Stuttgart, No. 19. 4th year. Stuttgart. Folio, illus. 4t.

Astronomy, Elements of—Hugo Reid. 4th ed., carefully revised and brought down to the present State of astronomical Science, by Rev. Alex. Mackay. Edinburgh. 12mo. 3s.

Building Manual; German—A Treatise on the Arts in their application to the Design and Construction of Buildings. Edited by the Publishers of the German Building Gazette. Berlin (German). 8vo, illus. 13t.

—; Manual of the Progress and Art of— Edited by Dr. H. Zwick. Leipzig (German). Published annually. 8vo. 3t.

Catalogue of new Books published in Germany and other Countries, upon mechanical and technical Subjects, also on the Science of Architecture and Engineering. Edited by D. W. Muelldener. (German.) January to June. 8vo. 4t.

Chemistry, Elements of—Theoretical and Practical. William Allen Miller, M. D., LL.D., &c. Part I. Chemical Physics. Corrected from the 4th London ed. New York. 8vo, illus. \$4.00.

—Introduction to the Study of Organic— the Chemistry of Carbon and its Compounds. Henry E. Armstrong, Ph. D. London. 12mo. \$1.75.

—The Principles of— and Molecular Mechanics. Dr. Gustavus Hinrich, Prof. of Physical Science in State Univ. of Iowa. New York. 8vo, illus. \$2.50.

Civil Engineer, The—an engineering Gazette, published by K. R. Bornemann. Leipzig (German). Vol. 20, text, 4to, folio plates. 10t.

Civil Engineering, Elementary Course of—for the use of cadets of the U. S. M. Academy. D. H. Mahan. With an Appendix and general Index. Edited by Prof. De Volson Wood. 2d ed. New York. 8vo, illus. \$5.00.

Cloths; The Theory and Practice of the Art of Designing Fancy Cotton and Woollen Cloths from Sample. Frederick T. Ashton. Philadelphia. Folio, illus. \$10.00.

Drawing, Manual of Topographical—R. S. Smith, U. S. Naval Academy, Annapolis. New ed., with new matter. New York. 8vo, illus. \$2.00.

Dwellings; Rudimentary Treatise on the Erection of Dwelling Houses. S. H. Brooks. New ed., with additions. (Weale's Series.) London. 12mo, illus. 2s. 6d.

Engineer, Weisbach's—A Collection of Tables, Forms and Rules of Arithmetic, theoretical and practical Geometry, and of Mechanics and Engineering. 6th ed., wholly revised, with contributions of Prof. F. Reuleaux. Braunschweig (German). 1st part. 12mo, illus. 4t.

Engineer's, Architect's and Contractor's Pocket-Book for 1874. London. 12mo, tuck. \$3.00.

Foundations; The Art of Preparing—for all Kinds of Buildings. Fred. Bauman. 12mo, illus. Chicago. \$0.75.

Irrigation; the Design and Works for—of Upper Italy, with Drainage. From Transactions of the Society of Architects and Engineers at Hanover. (German.) Folio, illus. 2t.

Marine Engineers; A Pocket-Book of Useful Tables and Formulae for—Frank Proctor. London. 32mo. 4s.

Natural Philosophy; Handbooks of—Dr. D. Lardner. New ed. On Electricity, Magnetism and Acoustics, edited by George C. Foster; on Hydrostatics and Pneumatics, by Benj. Loewy; on Optics, by T. Oliver Harding. London. 3 vols. 8vo. Each 5s.

Railroads; Destruction of—in Time of War. Lieut A. Leleny. Prague (German). 8vo. 3t.

— Handbook of Freight Traffic on German, Austrian and Hungarian Railroads, and of the local freight Tariffs. Berlin (German). 8vo. 23t.

— Journal of the Society of the Management of German Railroads—devoted to the Progress and Development of Railroads, from a technical Standpoint. Vol. II., new series. (German). 4to, illus. 63t.

Railroad System; The Organization of the Prussian State—By an experienced railroad Officer. Essen (German). 8vo. 3t.

Railway Manual, Shareholders' Guide and

official Directory for 1874. Bradshaw. London. 8vo. 12s.

Science; Annual Record of—and Industry for 1873. Edited by Spencer F. Baird, assisted by eminent Men of Science. New York. 12mo. \$2.00.

— Year-Book of Facts in—and Art, exhibiting the most important Discoveries and Improvements of the past Year in Mechanics and the useful Arts, general Science &c., &c. London, 1874. 12mo. 5s.

Screw-cutting Tables. 3d ed. W. A. Martin. Oblong. London. 1s.

Telegraphy, A Handbook of practical—6th ed. Revised and enlarged. London. 8vo. 16s.

Tunnel Construction; Lectures on—before the royal Schools at Vienna and Bruenn. 2d ed., with additions. Prof. John G. Schoen. Vienna (German). 8vo, text, 4to plates. 53t.

## LIBRARY AND MUSEUM.

### ADDITIONS IN APRIL, 1874.

NOTE—Members and others are asked to contribute regularly to the library of the Society, copies of government, municipal, railway, canal and other reports, specifications, profiles, maps, photographs and like matter, making up the record of engineering operations for the past or present, and to inform the Secretary where such may be had. Duplicate copies are desired, for transmission to foreign societies in return for works collected and sent to this library by them; also for exchange with members and others who wish complete sets referring to particular subjects. In order to gather material now considered of but little value, but of great future importance in the history of the public works of this country and a comparison of their economical results, donations are solicited of old reports or pamphlets, which in any way refer to their construction or operation.

### DONATIONS ARE ACKNOWLEDGED AS FOLLOWS:

From Claxton, Remson & Haffelfinger, Philadelphia, Pa.:

Handbook of the Locomotive, including the Construction, Running and Management of Locomotive Engines and Boilers, with illustrations, Stephen Roper. Philadelphia, 1874.

From Edward J. Corthell, C. E., Louisiana, Mo.:

Iron Railroad Bridge over the Mississippi River at Louisiana, Mo. Photograph.

From David W. Cunningham, C. E., South Framingham, Mass.:

Report of the Engineer to the Committee on Sewers and Drains of the City of Lowell, on a general System of Sewerage. Lowell. 1874.

From Joseph S. Dodge, C. E., Madison, Wisconsin:

Map showing Location of proposed Bridge of the Milwaukee & St. Paul Ry. Co., at La Crosse, Wis. Dec., 1873.

From the Editors and Publishers, (D. Appleton & Co.) New York:

The American Cyclopaedia, a popular Dictionary of General Knowledge. Vol. V. "Code-Demotica." New York, 1874.

From Caleb G. Forshay, C. E., New Orleans, La.:

Remarks by Prof. Forshay before the Senate and House Committees on the Improvement of Navigation at the Mouths of the Mississippi River. Washington, 1874.

From Heller & Brightly, Philadelphia: Engineers' Surveying Instruments. Philadelphia, 1874.

From the Institution, Birmingham, England:

Institution of Mechanical Engineers. Proceedings Oct. 30, 1873.

From Theodore F. Lee, Esq., New York:

Report of the Committee on Terminal Facilities of the New York Cheap Transportation Association, presented January 29th, 1874, with Facts and Statistics touching the Harbor, Trade and Commerce, &c., of the Port and City of New York, 1874.

The National Convention of the American Cheap Transportation Association, held at Washington, D. C., January 14–17th, 1874.

C. S. Maurice, C. E., Athens, Pa.:

The Alabama Central R. R. Bridge over Tombigbee River. Photographic views.

From Hon. William J. McAlpine, Albany, N. Y.:

Modern Engineering. Albany, 1874.

Report and Plans for a Supply of Water for the City of Norfolk, Va. William J. McAlpine, C. E. February, 1871.

From J. G. Moore & Co., Elizabethport, N. J.:

Certificates and Explanations in Relation to Burnettized Lumber, and its Reliability in resisting Decay, in the most exposed Situations. New York, 1873.



From Charles Paine, C. E., Cleveland, Ohio:  
 Annual Report of the Commissioner of Railroads and Telegraphs to the Governor of Ohio, for 1867-'73. 8 volumes. Columbus.  
 First Annual Report of the Commissioner of Railroads of Michigan, for the year ending Dec. 31st, 1872, with Railroad Laws of Michigan. Lansing, 1874.  
 Third Annual Report of the Railroad and Warehouse Commissioner, for year ending Nov. 30th, 1873. Illinois, 1873.

From F. B. Patterson, Esq., New York:  
 Fac Simile of an original Map of New York in 1728. New York, 1874.  
 New York Directory, 1786. A reprint. New York, 1874.

From Willard S. Pope, C. E., Detroit, Mich.:  
 Bridge or no Bridge—Address to Citizens at the Meeting called by the Committee appointed by the Board of Trade, held in Detroit, April 7th, 1874.

From the Public Library of the City of Boston:  
 Bulletin No. 29. List of the more important Books placed in the Library during January, February and March, 1874.

From the Society, London, England:  
 Society of Engineers. Transactions for 1861-'71. London. 11 volumes.

From the Society, Paris, France:  
 Transactions of the Society of Civil Engineers, July to December, 1873. Paris. (French). 2 volumes, 1873.

From Prof. Robert H. Thurston, Hoboken, N. J.:  
 Announcement of the Stevens Institute of Technology. Hoboken, 1874. (Copies for distribution.)

From Thomas M. Sherman, C. E., Rochester, N. Y.:  
 Reports of the Board of Water Commissioners of the City of Rochester, made November 15th, 1872, and January 1st, 1874. Rochester. 2 copies each.

From Lebbeus B. Ward, C. E., Jersey City, N. J.:

Practical Treatise on Railroads and Locomotive Engines, for the Use of Engineers, Mechanics and others. Description of edge, train, suspension, and all other Railways, and the various locomotive Carriages, &c., and Explanation of every Patent granted in England for Improvements in the Mechanism of Locomotives. Illustrated. Luke Herbert. London, 1837.

A Practical Treatise on street or horse-power Railways, their Location, Management, &c., and their comparative Advantages over the Omnibus System. Alexander Easton, C. E. Philadelphia, 1853.

System of useful Formule, adapted to the practical Operations of locating and constructing Railroads—a Paper read before the Boston Society of Civil Engineers, December, 1849. Simeon Borden, C. E. Boston, 1851.

Transactions of the Institution of Civil Engineers. Volumes I. and II. London, 1838, 1842.

Treatise on Railroads and internal Communications, compiled from the best and latest Authorities, with original Suggestions and Remarks. Thomas Earle, Philadelphia, 1830.

Treatise on the Steam Engine, historical, practical and descriptive. John Farcy, Engineer. Illustrated. London, 1827.

John Whitelaw, C. E., Cleveland, Ohio:  
 Tunnel under Lake Erie. Cleveland Water Works. 1874. 2 photographs.

From William E. Worthen, C. E., New York:  
 Report of Plan and approximate Estimates of Cost to supply the City of Indianapolis with Water. By William E. Worthen. C. E. Indianapolis, 1874.

#### BY PURCHASE.

Specifications and Drawings of Patents issued from the U. S. Patent Office for October, 1873. Washington.

## ANNOUNCEMENTS.

**MEETINGS.**—The next evening meeting of the Society will be held Wednesday, May 20th, at 8 o'clock P. M., when a paper by Prof. De Volston Wood, on "Hydraulic Motors" will be read, and "Practical Questions in Engineering" submitted by Edwin Thacher, C. E.—discussed.

The next stated meeting of the Board of Direction will be held on Monday, June 1st, at 2 o'clock, P. M. for the transaction of regular business.

The next afternoon meeting of the Society will be held Wednesday, June 3d, at 1 o'clock P. M., when a paper by W. Howard White, C. E., on "European Railways as they appear to an American Engineer" will be read, and a report of the Committee on founding a Testing Laboratory will be presented.

**THE SIXTH ANNUAL CONVENTION** of the Society will be held in New York, Wednesday, June 10th, and following, as announced in April Transactions.

The Committees are as follows:

Of Arrangements—The President, Col. Julius W. Adams, Gen. George S. Greene, Mr. William E. Worthen, Col. W. Milnor Roberts, and the Secretary, Mr. Gabriel Leverich.

On Invitations—Gen. J. G. Barnard, Hon. William J. McAlpine, and Mr. Thomas C. Clarke.

On Reception and Local Arrangements—Mr. Alfred P. Boller, Gen. Quincy A. Gilmore, Messrs. John D. Van Buren, Jr., Thomas F. Rowland, William W. MacLay, Theodore Weston and Arthur Spielmann.



On Procuring Papers (standing Committee on Library)—Mr. Charles Macdonald, Prof. De Volson Wood, and Mr. Francis Collingwood.

On General Transportation—Mr. O. Chanut, Chief Engineer Erie Railway, New York; Gen. I. M. St. John, Consulting Engineer Chesapeake & Ohio Railroad, Quinimont, Fayette Co., W. Vir.; Mr. Walter Katté, Engineer Keystone Bridge Co., St. Louis, Mo.; Mr. Thomas D. Lovett, Consulting Engineer Cincinnati Southern Railroad, Cincinnati, O.; Mr. Charles Paine, Gen. Supt. Lake Shore & Mich. Southern Ry., Cleveland, O.; Mr. Alexander J. Cassatt, Gen. Manager Pennsylvania Ry., Philadelphia, Pa.; Mr. William P. Shinn, Edgar Thompson Steel Works, Pittsburgh, Pa.; Mr. Ed. M. Reed, Gen. Supt. New York, New Haven & Hartford Railroad, New Haven, Conn.; Col. Alfred L. Rives, General Superintendent Mobile & Ohio Railroad, Mobile, Ala.; Mr. M. G. Howe, Chief Engineer Houston & Texas Central Railroad, Houston, Tex.; Mr. Joseph P. Davis, City Engineer, Boston, Mass.; Mr. Theophilus E. Sickles, Chief Engineer Union Pacific Railroad, Omaha, Nebraska; Mr. Mendes Cohen, President Pittsburgh, Washington & Baltimore Railroad, Baltimore, Md.; Mr. Jacob M. Clark, Resident Engineer Central Railroad of New Jersey, 119 Liberty street, New York; and Col. John G. Clarke, Richmond, Va.

On Wilkes Barre Excursion—Messrs. James Archbald, H. Stanley Goodwin, Frederick Mercur, and Martin Coryell.

On Finance (standing Committee)—Mr. John Bogart, Col. W. Milnor Roberts, and Gen. Theo. G. Ellis.

For the information of the Committees, members have been requested by circular to state to the Secretary whether they will attend the Convention—if so, over what routes they prefer to travel to and from New York, and whether they will contribute a paper—if so, what will be its title and probable length.

Full details of the programme for the Convention are not yet determined—a special announcement will be made in time by circular.

**IRON AND STEEL RAILS.**—The committee appointed to make an investigation and report on the form, endurance and manufacture of rails, find that the circular of inquiry has elicited fewer responses than was expected from the members of the Society and the superintendents and engineers of the principal railroads to whom it was sent.

In a second circular recently issued the committee state that this is, probably, to some extent, the fault of the committee, in not having allowed more time for gathering the somewhat minute information asked for,

which, in many roads, is not readily accessible. This consideration, the importance of the subject, and the great value of the information already secured in the returns which have been received have determined the committee to extend the investigation over the term of another year. It will, however, make a partial report at the Annual Convention, to be held in New York, June 10th and 11th, and hand in its final report in time for the next year's Convention. Those who have not already done so, are now asked to assist in this desirable undertaking, by making a prompt return upon the blank heretofore sent, taking such steps to gather the required information as may seem necessary.

Copies of the blanks issued will be sent on application, and such full returns are hoped for as will lead to correct conclusions and improved practice upon a subject so vitally important to the economy of our railroads. Communications should be addressed to M. N. Forney, Esq., Secretary of the Committee, 73 Broadway, New York.

A circular recently issued by the Secretary is here quoted:

**OLD REPORTS.**—There is in the possession of almost every one connected with this Society a collection of reports, circulars and similar publications, which, if arranged and preserved, would in time be invaluable as furnishing the material for a comparison and record of economic results pertaining to the public improvements of this country. The Society proposes to gather this matter (much of which in its present condition is useless rubbish, and therefore day by day thrown away and destroyed), and will assort, bind and preserve it for future reference. You are asked to collect whatever you can spare of such books, pamphlets, circulars, maps and like matter, and send them to the library here, by express or otherwise, at the cost of the Society; the donations, as received, will be acknowledged in the Transactions.

**PROPOSAL OF MEMBERS.**—In the practice of engineering are many of culture and experience not members of the society, who would confer honor upon it, and as such are admitted, its strength, influence and usefulness will increase. The rate and permanence of this growth very much depends on the individual effort of members—a little labor by each would soon double our numbers. You are solicited to aid in this by presenting the Society and its objects to those known to you in the profession who would be desirable members. For this purpose forms of application for admission are enclosed, and others will be sent as requested.

# AMERICAN SOCIETY OF CIVIL ENGINEERS.

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## PROCEEDINGS.

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### MINUTES OF MEETINGS.

(Abstract of such as may be of general interest to members.)

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#### OF THE SOCIETY.

MAY 20TH, 1874.—A stated meeting was held at 8 o'clock P.M.

A paper by W. Howard White, C. E., on "European Railways as they appear to an American Engineer,"\* was read, and a discussion by Messrs. Collingwood, Crosby, Worthen and Yardley followed.

A published communication from William J. M'Alpine, C. E., on "Dams for Reservoirs, should they be of Earth or Masonry?"† was read and discussed.

Messrs. James B. Francis, Theodore G. Ellis and William E. Worthen, were appointed a committee to examine and report upon the failure of the dam on Mill River, May 16th last, "not only to determine who were in fault, but also to assert the existence of the society as a body which purposes to exhibit the true causes of the failure of public works, and the engineering ability of those engaged in their construction."

Attention was called to a statement comparing the measurement of strains by weighted levers and hydraulic gauges, and the matter was discussed by Messrs. Collingwood, Leverich and others.‡

JUNE 3D, 1874.—A regular meeting was held at 1 o'clock P.M.

The vote on admission to membership was canvassed, and the following declared elected: Members, Schuyler Hamilton, C.E., of New York; Eugene F. Falconnet, C. E., of Louisville, Ky., and Nathaniel M. Edwards, C. E., of Appleton, Wis.; and Junior, William H. Burr, C. E., of Milburn, N. J.

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\* Transactions, LXXXIV.

† From the Albany Argus.

‡ See Notes and Memoranda, page 98.

A report from the committee appointed April 15th,\* to consider a plan for a "Testing Laboratory," was presented, adopted, and the committee continued to consult with other committees appointed by kindred bodies, fix upon a plan of organization, and the means of carrying it out.

The importance of securing a national recognition of the Society by federal charter or otherwise was discussed, and referred to a committee of the President and Vice-Presidents of the Society, to report thereon at the Sixth Annual Convention.

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## REPORTS OF COMMITTEES.

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ON A

### COURSE OF INSTRUCTION FOR STUDENTS IN ENGINEERING.

ADOPTED MAY 6TH, 1874.

The Committee to whom was referred the communication of Prof. Estavan A. Fuertes, asking the "Society to declare what should be the course of instruction in schools and colleges for students of engineering," respectfully presents the following report:

While the Committee fully appreciates the importance of the subject, yet we are of the opinion that the Society is not an advisory body in such matters. Even in regard to professional subjects it guards itself by declaring "that the Society is not responsible for the opinions expressed by its members,"† and much less would society action on matters pertaining to institutions of learning be considered binding or even advisory. The nearest practical approach to such a position would be the securing of a discussion upon the subject, in which each member would be free to express his opinion, and leave the educator free to draw inferences therefrom.

It is impossible for any body of men to outline a course of instruction which would generally be considered "best," independently of the circumstance which induced them to establish it; and as the circumstances are constantly changing, so courses of study change, in order to be considered "up to the times." In our opinion, the institutions of

learning should be left free to construct their courses, and no attempt should be made to mould these after a fixed pattern. The differences which exist between them will then be put to practical tests, and, as they will naturally watch the progress of each other, as well as profit by the criticisms of men in active life, we think that this will in the end lead to the best practical results.

Should this report end at this point, some might infer that we are indifferent to the subject of technical education, and are willing to commit the Society to such a position. On the contrary, we are decided supporters of it, and think that the Society must be, since, on defining the qualifications for membership, it declares "a diploma from any collegiate institution in good standing conferring the degree of C. E. shall be considered equivalent to two years' service."<sup>\*</sup>

Without disparaging the functions of this Society, it is our opinion that schools of engineering have done more to elevate the standard of the engineering profession than any other single agency. All that pertains to theory and all the classified, practical sciences can and should be taught in the schools. There will always be a practical difficulty in determining the extent to which the details of construction should be taught. It is evidently absurd for the schools to attempt to make experts in any branch of the

\* Page 85. † Page 59.

‡ Put on the title page of Transactions, by resolution of the Society passed November 15th, 1870.

\* Constitution, Art. XVII.

profession; but this is not a sufficient reason for not teaching, so far as possible, all the *principles* which pertain to practical operations; such as field-work, shop practice, office-work, &c.

The subjects which are intended more especially to promote "broad culture" as popularly understood, are not necessary parts of a professional course; they naturally precede technical courses. The system of technical education in this country—if it can be called a system—has peculiarities which have grown out of the circumstances surrounding it. Nearly all the technical schools here devote one or two years to general science and literature—which are no more technical than the old and more purely classical courses. These years are properly preparatory to those which follow. Had we a general system of education, as thoroughly graded as that in Germany, the technical schools would not necessarily be burdened with this preparatory work; but all things considered, we doubt not but more thorough work has been done by the system which generally prevails here than would have been by confining the instruction to professional subjects. We ought not to import a foreign system, but seek to build one here especially adapted to our times and circumstances. Our schools ought not to graduate men with a mere "smattering" of the sciences they are to use, but the instruction should be thorough and the standard of

graduation high. If an error is made in either direction, the schools should be *too* theoretical rather than *too* practical. The former gives a solid basis upon which to build the professional structure.

It makes but little difference what degree is conferred at graduation; but if that of "Bachelor of Engineering" instead of "Civil Engineer" on the ground that the latter implies a certain amount of practical experience, then we respectfully submit that the latter should be conferred only by a body of practical engineers; such for instance as this Society. In the sense, however, that the candidate has acquired a thorough knowledge of the "Science of Engineering," we see no impropriety in conferring the latter at graduation. The student can become a "Master of Engineering" only by long and varied experience.

Those who desire information upon this subject are referred to the following works:

Report upon Technical Education to the Institution of Engineers, England, made by a committee of that body. London, 1870.

Report of the U. S. Commissioner, J. W. Hoyt, on Education in Europe and America. Washington, 1870.

Report of the Committee of the Trustees of the Rensselaer Polytechnic Institute. Troy, 1870.

Respectfully submitted,

DE VOLSON WOOD,  
Chairman.

## ON FOUNDING A TESTING LABORATORY.

ADOPTED JUNE 30, 1874.

The Committee appointed\* to consider and report upon the proposal to establish a "Testing Laboratory" in connection with the Stevens Institute of Technology, as set forth in the correspondence between Professor Robert H. Thurston and the Trustees of the Institute† respectfully report as follows:

After careful consideration of the subject, the committee is of opinion that the proposal possesses great merit, and should be encouraged by the American Society of Civil Engineers, for the following reasons:

1. Because it would afford a ready means of settling authoritatively many questions which

come up in daily practice, and upon which there is now considerable divergence of opinion.

2. Because it would substitute for individual efforts and experiments, an organized body through which Engineers could carry on desirable investigations.

3. Because this laboratory being connected with an institution of such high repute as the Stevens Institute, and being managed by purely professional men, it would be removed beyond mercantile influences, and results published under its seal would be received with a degree of confidence otherwise unattainable.

4. Because if prudently and economically managed, the cost of experimenting would

\* Page 85.

† Copies of which can be supplied by the Secretary.

be largely reduced, and the duplication of experiments avoided.

For these reasons the Committee believes that the Society should take a share in fostering and organizing the project. There are, however, many other interests and bodies to be consulted; railroad officials, manufacturers, and managers of metallurgical works, chemists and mining engineers, are interested in the matter, quite as much as Civil Engineers, and no plan of organization would be complete unless they were conferred with. The Com-

mittee therefore recommends that the Society appoint a special committee, to consider the subject further, to meet with such committees as may be appointed by the other parties which have been mentioned, and discuss a plan of organization, and the ways and means for carrying it out; with instruction to report the same to the Society for its action thereon.

Respectfully submitted,  
O. CHANUTE, ALF. P. BOLLER,  
RICHARD H. BUEL, *Committee.*

## NOTES AND MEMORANDA.

Members are desired to contribute selections from their note books and similar records of experience referring to engineering practice, and those seeking information are asked to suggest professional topics for discussion.

### ELEMENTS OF COST OF RAILROAD TRAFFIC.

—The following subjects of enquiry are suggested :

Has not the practice of using much false or temporary work in the construction of railroads, greatly increased the operating expenses?

Cannot lighter cars be used without lessening their strength; whence the section of rail, weight of locomotives and the proportion of dead to paying weight may be reduced?

Can freight and passenger trains be run economically on the same track, the speed of the two being so different; and should not each, on lines of much traffic have its own track?

In the southwest, one great expense in freight transportation is that the trains generally are well loaded but one way. Cannot several connected roads arrange a circuit of travel for the cars, so that they usually will move in the direction of the traffic?

MEASUREMENT OF STRAINS BY TESTING MACHINES.—Recently experiments were made at the Standard Chain Works, East Bridgewater, Mass., for the U. S. Navy Yard, Washington, to compare the measurements of strains by weighted levers with that of a hydraulic gauge—the specimens tested being placed between the system of levers, and the hydraulic press. The indications of strains in tons were as follows :

Lever.	Gauge.	Per ct. error.	Lever.	Gauge.	error.
19.13	20	4.5	46.38	90	94.0
22.63	25	14.7	48.31	95	96.6
25.75	30	16.5	49.75	100	101.0
28.25	35	23.5	50.63	105	107.4
32.25	40	24.0	52.75	110	108.5
34.75	45	29.8	54.25	115	112.0
36.05	50	38.8	57.63	120	108.2
39.13	55	40.5	59.75	125	109.2
39.75	60	50.9	60.88	130	113.5
41.13	65	58.0	63.00	140	122.2
42.06	70	66.4	65.75	150	128.1
42.75	75	77.8	69.00	160	131.9
43.88	80	82.3	72.00	170	136.1
45.25	85	87.8	.....	.....	.....

In this comparison, assuming that the strains were correctly measured by the levers, the errors in the hydraulic gauge records are less than here shown, as the friction of the ram is included.

That this should be small appears from a

well conducted series of experiments on the friction of hydraulic presses, made by John Hick, C. E.,\* whereby it was determined that for rams of different diameters, if the pressure per unit of area be the same, the friction of the leathers increases as the diameters or the square roots of the respective gross loads; this was with pressures from 188.7 to 6375 pounds per square inch on rams of 4 and 8 inches diameter respectively.

It was found that this friction equals the product of diameter of the ram in inches, the pressure in pounds per square inch, and a co-efficient which is .0471 for new or badly lubricated leathers and .0314 for those in good condition. The following table gives the frictional resistance in percentage of the to-

tal hydraulic pressure for rams from 2 to 20 inches in diameter.

DIAMETER	PER CENT.	DIAMETER	PER CENT.
2	2.00	12	2.33
3	1.33	13	0.30
4	1.00	14	0.28
5	0.80	15	0.26
6	0.66	16	0.25
7	0.57	17	0.23
8	0.50	18	0.22
9	0.44	19	0.21
10	0.40	20	0.20
11	0.38		

\*Experiments on the Friction of the Leather Collars in hydraulic Presses, conducted by John Hicks, C. E. London, E. & F. N. Spon, 1867.

#### NEW BOOKS ON

### ENGINEERING AND TECHNOLOGY.

Under this head will be announced new books on these and kindred subjects in English, French and German, which may be professionally useful to members of the Society.

The original titles of foreign books noted here will be furnished, on request.

At the present rates of duty and exchange, the cost of imported books may be estimated in federal money, at one shilling equal to 50 cents, one franc to 37 cents, and one thaler to \$1.23.

Air, On the thermal and mechanical Properties of Air and other permanent Gas, subjected to Compression or Expansion. Prof. R. H. Thurston. Philadelphia. 8vo. illus. \$0.50.

Ambulance, History of the American—established in Paris during the Siege of 1870-71, together with the Details of its Methods and its Works. Thomas W. Evans, M. D. New York. 8vo. illus. \$8.00.

Annual of Art, the Sciences and military Technology—published by P. Henrard—1st year, 1873. Brussels (French). 12mo. \$3.00.

Antiquities, Trojan—Report of the Exhumations at Troy. Dr. H. Schliemann. Leipzig (German). 8vo, text, folio atlas, photographic plates. 70s.

Arches, Theory of—Prof. W. Allan. New York. 18mo. illus. \$0.50.

Architect's Album, a Collection of 70 steel Plates with explanatory Text. E. F. Le Preux. (Treats principally of the styles which have prevailed in Paris since 1865). Paris (French). 8vo. 25f.

Proceedings of the 7th Annual Convention of the American Institute of—held in Chicago, Oct. 15th, 17th, 1873. New York. 4to.

Architectural Antiquities of Rome, with 130

plates. G. L. Taylor and E. Cresy. New ed. London, folio. \$13.50.

Architecture, Ornamentation of the transitional Period of British—E. Sharpe. Part 2. London. \$4.20.

School—Being Practical Remarks on the Planning, Designing, Building and Furnishing of Schoolhouses. E. R. Robson. London. 8vo. illus. \$15.75.

The Stepping-Stone to—Consisting of a series of Questions and Answers, explaining in simple Language the Principles and Progress of Architecture from the earliest Times. Thomas Mitchell. New ed. New York. 24mo. illus. \$0.60.

Artillery Exercise, Manual of—16mo. London. 1s. 6d.

Assayer, The Practical—Containing easy Methods for the Assay of the principal Metals and Alloys. Principally designed for Explorers and those interested in Mines. Oliver North. London. 12mo. illus. \$3.75.

Astronomical and meteorological Observations made during 1871, at the United States Naval Observatory. Rear-Admiral B. F. Sands, U. S. N., Superintendent. Published by authority. Washington. 4to.

Atlas, Modern—A Series of 27 Maps, with Index. Edinburgh. 4to. 5s.



- Bridges. A Treatise on Bracing, with its Application to Bridges and other Structures of Iron and Stone. Robert H. Bow, C. E. Reprint. New York. 8vo, illus. \$1.50.
- Building, public Works and industrial Arts. Annual of—E. Sageret. 44th year. Paris (French). 8vo. 5½f.
- The Art of—among the Romans. A. Choisz. Paris (French). 4to, illus.
- Carpenters and Builders' Assistant and Wood-Workers' Guide. Lucius D. Gould. New York. 8vo, illus. \$3.00.
- Chemical Analysis, Tables for Qualitative—with an introductory Chapter on the Course of Analysis. Prof. H. Will. 2d. American, from the 9th German edition. Edited by Chas. F. Himes, Ph. D. Philadelphia. 8vo. \$1.50.
- Coal as a Reservoir of Power. Robert Hunt, F. R. S. Boston. 12mo. \$0.25.
- Statistics of the Coal Trade for 1873. Pottsville. 8vo. \$0.25.
- Compensations. A Text-Book for Surveyors, in tabulated Form. B. Fletcher. London. 8vo. 5s.
- Cotton, Practical Cotton Spinner and Manufacturer. 8th ed. Manchester. 8vo, illus. 12s.
- Cyclopadia. The American—A popular Dictionary of general Knowledge, edited by George Ripley and Charles Dana. Vol. V. Codes—Demonitica. Vol. VI. Dempster—Everett. New York. 8vo. Each \$5.00.
- Dynamite. The Transportation and Storage of—Louis Ronx, Director of Government Manufactures. Paris (French). 18mo. 1f.
- Egypt. History of the principal Works executed in—, from the most ancient Times to the present Day. Linant de Bellefords, Bey. Paris (French), text large 8vo, folio plates. 70f.
- Electro-dynamics and Electro-magnetism. Study on—M. Glosener. Paris (French). 8vo. 4f.
- Enamel Painting, Practical Instructions in—on Glass, China, Tiles, &c.; to which is added full Instructions for the Manufacture of the Vitreous Pigments required. Henry J. Snell. 8vo, illus. 2s. 6d.
- Engineering, Modern—W. J. McAlpine. 2d ed. New York. 8vo. \$1.50.
- Spon's Dictionary of—Civil, Mechanical, Military and Naval. With technical Terms in French, German, Italian and Spanish. Vol. 8. Completing the work. London. 8vo. \$5.00.
- Engineers' German—Journal of the Society of—edited by R. Zeibath, aided by Dr. E. F. Duerre, Dr. K. List, Prof. H. Ludewig and Prof. R. R. Werner. Berlin (German). Vol. 18. 4to, illus. 7½t.
- Explorer's, Miner's, and Metallurgist's Companion. J. S. Phillips. 2d ed. London. 8vo. 31s. 6d.
- Explosives, Majendie's (Parliamentary) Report on Gunpowder and other Explosives. London. 8vo. 10d.
- Fortifications and Military Construction. Memoirs on—for the Use of Engineer Officers. Published by the Committee on Fortifications. Paris (French). 8vo, illus.
- of Capitals and Investment of intrenched Camps. A. Brialmont, Col. of Staff. Paris (French). 8vo, with maps. 7f.
- Fuel, how to save—Rev. S. Baring Gould, M. A. London. 12mo. \$0.50.
- Gas Works, Instructions for the Management of—W. C. Holmes. London. 8vo. \$1.50.
- Gazetteer, the Centennial—of the United States. A. Von Steinwehr. Philadelphia. 8vo.
- Geology—Contributions to the extinct Vertebrate Fauna of the Western Territories United States Geological Survey. Vol. I. Joseph Leidy. Washington. 4to, illus.
- of the Present examined and demonstrated. B. Von Cotta. Leipzig (German). 4th ed. 8vo. 8s.
- Students' Elements of—2d ed., revised and corrected, with a new Table of British Fossils. Sir Charles Lyall. London. 8vo, illus. 9s.
- Geometry, Mechanics—Robert Biddell. 4to, illus. New York. \$5.00.
- Treatise on plane co-ordinate—as applied to the straight Line and the conic Sections, with numerous Examples. I. Todhunter, M. A. London. 12mo. \$2.25.
- Treatise on the analytic—of Three Dimensions. George Salmon. Dublin. 3d ed. 8vo. 1s.
- Heat, Molecular Movements of Bodies, from the physical Effects of—Cavalette Daynard. Paris (French). 8vo. 1¼ frs.
- Hydraulics, the Construction of Mill Dams, comprising also the Building of race and reservoir Embankments and head Gates, the Measurements of Streams, Gauging of Water Supply, etc.—James Leffel. Springfield, Ohio. 8vo, illus. \$2.50.
- Hydrographic Notes, furnished by the Hydrographic Bureau of the Royal Admiralty (a weekly publication). Berlin (German). Semi-annual volume. 4to. ½t.
- Interest Tables simplified, in which the Interest is placed immediately under the Principal, giving at 6, 7 and 10 per cent. the Interest on any Sum up to \$900,000, and presenting four Months on an open Page. Also, Tables at 36 per cent. for the Equation of Payments. And a few simple Rules for facilitating Calculations of Interest, Discount, &c. Henry W. Law. Chicago. 4to. \$3.00.
- Iron and Steel Institute, Journal of—Vol. 1. London. 8vo.
- at the Vienna Universal Exposition. A. Kerpely. (German.) 8vo. Schmitz and Joerges. 3t.
- Trade, a new Guide to the—James Rose. 25 ed. London. 8vo. 8s. 6d.
- Logarithms, Short—and other Tables. London. 8vo. \$0.60.
- Machines, Elementary Parts of all Kinds of—D. A. Casalonga. 1st part. (The whole work will form an album of 80 plates.) Paris (French). 4to., illus. 12½f.
- their History, Description and Uses—Emile With. 2 vols. Paris (French). Large 8vo, illus. 16f.
- Theory of—or Treatise on Cinematics,—Ch. Laboulaye. 2d ed. Paris (French). Large 8vo. 15f.
- Mathematics Pure—including Arithmetic, Algebra, Geometry, and Plane Trigonometry. Edward Atkins. London. 12mo. 2s. 6d.
- Mechanical Engineers, Institution of—Proceedings 29th January, 1874. Birmingham. 8vo.
- Mechanics; Elementary Treatise on—S. Parkinson. 5th ed., revised. London. 8vo. 9s. 6d.
- applied to Machines—J. V. Poncelet, edited by M. Kretz. Paris (French). 8vo, illus.
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- C. P. Boilear. 4th ed. Paris (French). Large 8vo. 12f.
- Mechanics—Course on Mechanics and Machinery taught at the Polytechnic School, 3d part, Dynamics and Hydraulics. M. E. Bour. Paris (French). 8vo.
- Handbook of applied—Henry Evers, LL.D. London. 12mo. 1s. 6d.
- Principles of—T. M. Goodroe. London. 12mo. 3s. 6d.
- Theoretical—for Junior Students; A Text-Book for the elementary Stage of the science and art Departments. Syllabus, containing the examination Questions from 1861 to 1872. Wm. James Brown. Manchester. 12mo. 1s.
- Mineralogy, Descriptive.—comprising the most recent Discoveries. Prof. J. Dana. 3th ed., almost entirely rewritten and greatly enlarged; including an appendix by Prof. Geo. J. Brush, and further recent corrections. New York. 8vo, illus. \$10.00.
- Minerals, their History and Uses in the Arts and Manufactures—Emile With. Paris (French). Large 8vo, illus. 15f.
- Mines, Management of—Supplement. A. Burat. Paris (French). 8vo.
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- Nautical Almanac, or complete Ephemeris for 1876—for the Determination of Latitude, Longitude and Time on the Ocean, from astronomical Observations. Prof. C. Bremiker. Published at Request of the Prussian Minister of Commerce, Industry and Public Works. Berlin (German). 8vo. 3t.
- Naval Architecture: An Elementary Treatise on Wood and Iron Shipbuilding. Samuel J. P. Thearle. Vol. 1. London. Text. 12mo. 1s.
- Rudiments of—4th ed., corrected. James Peake. London. 12mo. 3s. 6d.
- Battle—The Gun, Ram, and Torpedo Manœuvres and Tactics of—in the present Day. The Influence of modern Ships and Weapons on a Naval Action on the open Sea—G. H. U. Noel. With 2 Essays by J. K. Claughton and Lt. Chas. Campbell. London. 8vo, illus. \$4.25.
- Ordnance Memoranda No. 17. Report of the Board of Officers on Gatling Guns of large Calibre for flank Defence. Washington. 4to.
- Survey. (Parliamentary) Report for 1873. London. 8vo. 3s.
- Ornamental Treasures. The most important Ornaments as applied to the different styles of Buildings—a complete History of Ornaments and Ornamentation, with Designs for Architecture, Furniture, Articles of Industry and Science, &c. 3d ed. D. Guilmard, Leipzig (German). 4to, illus. 3t.
- Ornament, Catalogue of antique Sculpture, with an Introduction to the Study of Ornament. W. T. Brigham. Boston. 4to, illus. \$15.00.
- Patents, certified Copy. Specifications and Drawings of Patents issued from the United States Patent Office for October, November and December, 1873. 3 vols. Washington. Large 8vo.
- Periodical Literature of the United States of America, with Index and Appendices. E. Steiger. New York. 4to. \$4.00.
- Plotting from Notes. M. Barthaud. 8vo. Paris (French). 8vo. 2f.
- Polytechnic Gazette; a popular Publication—edited by Dr. Herm. Grothe, aided by members of the German Civil Engineers' Society, the Polytechnic Society in Berlin, and others. Berlin (German). 4to, yearly. 6t.
- Proportion. Rules of—compiled and original, and adapted to modern Practice—D. T. Atwood. (Issued by the author in 1867, now for the first time offered.) New York. 12mo, illus. \$1.00.
- Pyramid. Our Inheritance in the Great—Piazzi Smyth, F.R.S., etc. New and enlarged ed., including all the most important Discoveries up to the present Time. London. 8vo, illus. \$6.00.
- Pyrometer, Notes on a—based on the Expansion of Gas. M. Lamy. Lille (French). 8vo, illus.
- Railroads during the War of 1870-71. (Lectures at the School of Bridges and Highways.) F. Jacquin. 2d. ed. Paris (French). 18mo.
- of Peru, with Statistics and Geography of the Country. Paris (French). 8vo.
- Railway Accidents. Circular of Board of Trade referring to (Parliamentary Report). London. 8vo. 1s.
- Construction. Elementary and practical Instructions in the Science of—Sir R. M. Stephenson. 5th ed., revised and considerably augmented by Edward Nugent. London. 12mo. \$1.20.
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- Rules. A pocket Book of useful Rules and Formulas for marine Engineers. Frank Proctor. London. 32mo, tucks. \$2.00.
- Sanitary Arrangements for Dwellings. Intended for the Use of Officers of Health, Architects, Builders and Householdiers. William Eassie. New York. 8vo, illus. \$2.75.
- Seamanship. 5th ed., revised and corrected, with 400 Illustrations and colored Sheets of signal Flags, new code Pendants, numeral Flags, &c. Capt. G. Nares. London. 8vo. 21s.
- Scientific Instruction (Parliamentary Report). Vol. 2. Minutes of Evidence. London. 8vo. 6s. 3d.
- Shipwrecks; Journal of the German Society for the rescuing of shipwrecked Persons, edited and published by the Society. Bremen (German). Quarterly. 8vo. Each 3t.
- Steam Boilers, A Treatise on—Their Strength, Construction and economical Working. 2d ed., revised. R. Wilson. London. 12mo. 6s.
- Economy in the Use of—A Statement of the Principles on which a Saving of Steam can best be effected. Frank Salter. London. 8vo. \$1.40.
- Engines, Compound—Translated from the French of A. Mallet. New York. 16mo. \$0.50.
- Expansion Notes on different Systems of—M. Cox. Lille (French). 8vo, illus.
- Manual of—and other prime Movers. 7th ed. W. J. M. Rankine. London. 8vo. 12s. 6d.
- Portable and partly portable—at the Vienna Exposition. S. Gottlieb. Leipzig (German). 8vo. 2t.
- Strength of Materials, Course of Mechanics, applied to—M. de Mastaing, Professor at the Ecole Centrale. Paris (French). Large 8vo, illus. 15f.
- Sub-Marine Exploration, with Outfit for

Sounding (or Boring), etc., etc., by Jules Girard. Paris (French). 8vo, illus. \$2.00.  
 Surveying and Plotting. Manual of—Barre and Roussell. Paris (French). 8vo, illus. 3½f.

— Gazette; Journal of the German Geometer Society. Stuttgart (German). Vol. 3. 8vo. 2f.

Telegraph Code, The A B C Universal commercial electric—, especially adapted for the use of Merchants, Shipowners, Brokers, Agents, &c. W. Clauson Thue. London. 8vo. \$4.25.

— The Electric—Dionysius Lardner. New ed., revised and re-written by Edward B. Bright. London. 8vo, illus. 2s. 6d.

Topography, Practice of—in the Field. By a Staff-officer. Paris (French). 12mo. ½f.

War, Franco-German, 1870-71. 1st Part, 4th Section: Advance of the 3d Army to the Moselle; Proceedings of the 1st and 2d Armies to the Night of the 14th August. Translated from the German official Account by Capt. F. C. H. Clarke. London. 8vo, illus. 4s.

War, Franco-German, Operations of the German Engineer Corps in 1870-71 (official). Goetz. Translated by Gillon and Fritsch. Vol. 2. 9 maps. Paris (French). 8vo, illus. 7f.

— Narrative of military Operations directed during the late War between the States. Joseph E. Johnston, C. S. A. New York. 8vo, illus. \$5.00.

Water Supply, of Nimes and London. M. Dumont. Paris (French), 4to text, atlas plates. 25f.

Winds and Currents, Mechanics of—A. Anst. Paris (French). Large 8vo, illus. 3f.  
 Wood and its Uses: a Handbook for the Use of Contractors, Builders, Architects, Engineers, Timber Merchants, &c., with Information for Drawing-up Designs and Estimates. P. B. Eassie. Gloucester. 8vo, illus. 1s. 6d.

Yacht Sailor: a Treatise on practical Yachtmanship, Cruising and Racing. By Vanderdecken. With Notes and additional Chapters by a Clyde Yachtman. 4th ed. London. 8vo. 7s. 5d.

## LIBRARY AND MUSEUM.

### ADDITIONS IN MAY, 1874.

NOTE.—Members and others are asked to contribute regularly to the library of the Society, copies of government, municipal, railway, canal and other reports, specifications, profiles, maps, photographs and like matter, making up the record of engineering operations for the past or present, and to inform the Secretary where such may be had. Duplicate copies are desired, for transmission to foreign societies in return for works collected and sent to this library by them; also for exchange with members and others who wish complete sets referring to particular subjects. In order to gather material now considered of but little value, but of great future importance in the history of the public works of this country and a comparison of their economical results, donations are solicited of old reports or pamphlets, which in any way refer to their construction or operation.

### DONATIONS ARE ACKNOWLEDGED AS FOLLOWS:

From American Institute of Architects, New York:  
 Proceedings of the Sixth Annual Convention of the Institute, held in Chicago Oct. 15th-17th, 1873. A. J. Bloor, Secretary, Editor. New York, 1874. (2 copies.)

From William Arthur, C. E., Brooklyn, N. Y.:  
 Cosmos, A Sketch of a physical Description of the Universe. A. Von Humboldt. 5 vols. New York, 1859.

Office and Works, Chrome Steel Works, Brooklyn, N. Y., Photograph.

From Austrian Society of Engineers and Architects:  
 Journal of the Society. 1874. 2 numbers. Vienna.

From the Board, Boston, Mass.:  
 Fifth annual Report of the Board of Railroad Commissioners. January, 1874. Boston.

From William S. Barbour, C. E., Boston, Mass.:  
 Treatise on Military Engineering. M. de Vauban. London, 1722.

From Gen. J. G. Barnard, New York:  
 Letter from Secretary of War, in answer to the Resolution of the House of April 14th, 1874, transmitting a Report upon the James River and Kanawa Canal Project. Washington, 1874. (2 copies.)  
 United States Coast Survey Chart, of Delta of the Mississippi.

From William H. Boardman, Esq., New York:  
 Comparison of the Merits of the Mode of building iron truss Bridges in America and Europe. Charles Bender, C. E. New York. 1874.  
 English vs. American Bridges. New York. 1874.

From the Engineer's Club of St. Louis, Mo.:  
Nitro Glycerine, a Paper read by Robert Moore, C. E., before the Club. 1874. (10 copies.)

From Joseph P. Davis, C. E., Boston, Mass.:  
Report of the Joint Committee on Water, in Reply to various Orders of the City Council, pertaining to additional Supply of Water, with Report of the City Engineer. Boston, 1874. (2 copies.)

From the Department, Washington, D. C.:  
Reports of the Department of Agriculture for April and May, 1874. 2 numbers. Washington.

From Richard D. Dodge, C. E., Brooklyn, N. Y.:  
Profile of Passes of the Mississippi compiled from Maps. 1874.  
Sketch of St. Clair Flats, showing the Position of the Canal, and the national Boundary. 1874.

From James B. Eads, C. E., St. Louis, Mo.:  
Correspondence between the business Men of New Orleans and James B. Eads. Washington, 1874. (2 copies.)  
Improvement of the Mouth of the Mississippi River. Washington, 1874. (2 copies.)  
Inaugural Address before the St. Louis Academy of Science, by the President, James B. Eads, C. E. January 15th, 1872. Washington, 1874. (2 copies.)  
Mouth of the Mississippi—Canal and Jetties compared. Washington, 1874. (2 copies.)

From the Editors and Publishers (D. Appleton & Co.), New York:  
The American Cyclopaedia, a popular Dictionary of general Knowledge. Vol. VI. "Dempster-Everett." New York, 1874.

From Gen. Theodore G. Ellis, Hartford, Conn.:  
Twenty-first annual Report of the general Railroad Commissioners of the State of Connecticut for 1874, with the Annual Report of the Railroad Companies for 1873. Hartford, 1874.

From James C. Fitzpatrick, Esq., New York:  
The Mitchell Safety Steam Generator. New York, 1874.

From Gen. Quincy A. Gillmore, New York (another copy also from Gen. S. V. Benét, Chief of Ordnance, U. S. A., Washington, D. C.):  
Report of Board of Officers appointed May 31st, 1873, on Gatling Guns of large Calibre for flank Defense. Ordnance Memoranda No. 17. Washington, 1874.

From John C. Goodridge, M. D., Brooklyn, N. Y.:  
Beton Coignet, a Description of the Material and its Uses in France and America. New York, 1874. (2 copies.)

From John M. Goodwin, C. E., Cleveland, Ohio:  
Alizerine, natural and artificial—  
Annual Statement of the Trade, Commerce and Manufactures of Cleveland for 1870. Cleveland, 1871.

Diagram for Frogs and Switches, Atlantic & Great Western R. R.

Inventory of the Property in Possession of Gen. Robert B. Potter, Receiver of the Atlantic & Great Western R. R. Meadville, 1867.

Local Press on the Erie Railway Management. January, 1872. Albany.

Signals for Use in the Field.  
Specifications forming Part of U. S. Letters Patent on Improvement in Bridges and in electric Railway Signals. John M. Goodwin, Inventor. 2 numbers.

Statistics and Information relative to the Trade and Commerce of Buffalo for 1872-3. Buffalo. 2 vols.

Swineford's History of the Lake Superior Iron District, its Mines and Furnaces. 2d ed., containing Report for 1870. Marquette, 1871.

Treatise on the Art of constructing oblique Arches with spiral Courses. Wm. Donaldson. London, 1867.

Treatise on Boiler Explosions, their Causes and Manner of preventing Disasters. Day-ton, 1873.

From William H. Grant, C. E., New York:  
The Roads and Walks in Central Park, being a Description of their Mode of Construction. William H. Grant. Chicago, 1865.

From James H. Harlow, C. E., Boston, Mass.:  
Graduating Double Plunger Pumping Engine, Pittsburgh Water Works. Photograph.

From the Institution of Mechanical Engineers, England:  
Proceedings 29th January, 1874. Birmingham.

From the Iron and Steel Institute, England:  
Journal of the Institute. Newcastle-upon-Tyne, 1874.

From G. Leverich, C. E., New York:  
Catalogue of Books in the Mercantile Library of the City of New York. 1866.

Ericsson's Caloric Engine. New York, 1860.  
Facts as to hooped Guns. R. P. Parrott. New York, 1862.

Forty-second Annual Exhibition of the American Institute. Catalogue. New York, 1873.  
Inefficiency of heavy Ordnance, in this Country and Elsewhere, and about Parrott and other hooped Guns. Norman Wiard. Washington, 1865.

Infantry Tactics, or Rules for Exercise and Maneuvers of the U. S. Infantry. Maj. Gen. Winfield Scott. 4 vols. New York, 1861.

Manual of Blowpipe Analysis, for the Use of Students. William Elderhost. New York, 1856.

Manual of principal Instruments used in American engineering and Surveying. W. & L. E. Gurley. Troy, 1862.

Manufacture of small Arms at Home vs. their Purchase abroad. Norman Wiard. New York, 1863.

Marine Artillery, as adapted for Service on the coast and inland Waters. Norman Wiard. New York, 1863.

Memorial of Norman Wiard to the Senate and Representatives in Congress. New York, 1863.

Navy of the United States, an Exposure of its Condition and the Causes of its Failure. Edward N. Dickerson. New York, 1864.

- Plain Talk with practical Painters. New York.
- Rensselaer Polytechnic Institute, Annual Register from 1855 to 1869. 12 numbers. Troy.
- . Graduating Exercises of the Class of 1857—Class of 1858. 2 numbers. Troy.
- . Its Reorganization in 1849, '50; its Condition at the present Time; its Plans and Hopes for the Future. B. Franklin Greene. Troy, 1855.
- . Papers of Association of Graduates of ——. Troy, 1870.
- Report on the Gothic Arch Elevated City Railway. Richard P. Morgan. New York, 1872.
- Specifications of a revolving Iron Fort mounting eight 15-inch Guns. James T. Ryan. New York, 1867.
- Steam on the Canals: Report of the Commission appointed. Albany, 1872.
- System of field Artillery, as improved to meet the Requirements of Service. Norman Wiard. New York, 1863.
- From the Light-house Board, Washington, D. C.:
- Memoir upon the Light-house Illumination of the Coast of France. L. Reynaud, Washington, 1871.
- Memoir upon the Lighting, Beaconage and Buoyage of the Coasts of France. L. Reynaud. Washington, 1871.
- Reports of the United States Light-house Board for 1872-3. 2 vols. Washington.
- From J. H. Linville, C. E., Philadelphia, Pa.:
- The Keystone Bridge Company's illustrated Album, embracing Iron Bridges, Columns, Chord Links, Roofs and Shapes, with Description of long-span Bridges, Quality of Materials, and Principles of Construction. Pittsburgh, 1874. (Copies for distribution.)
- From William J. McAlpine, C. E., Albany, N. Y.:
- Annual Report of the Superintendent of the Aqueduct at Montreal for year ending January 31st, 1864. (French.) Montreal.
- Annual Report of the Superintendent of the Montreal Water Works for year ending January 31st, 1869. Thomas C. Keefer, Montreal.
- Montreal Water Works. The Reports of Walter Shanley, Thomas C. Keefer, and James B. Francis, reviewed by William Rodder. Montreal, 1869.
- Reports and Estimates for a Ship Canal and Basin from Albany to New Baltimore. By William J. McAlpine and others. Albany, 1853.
- From Charles Paine, C. E., Cleveland, Ohio:
- Griffith's Live Stock Annual for 1874. Chicago.
- From Charles E. Paine, C. E., Providence, R. I.:
- Annual Reports of the City Engineer for 1872-3. 2 vols. Providence.
- Report of Committee on Parks, Oct. 13th, 1873. Providence.
- Message from the Mayor relating to the Efficiency of the Fire Department, &c., presented Dec. 21st, 1872. Providence.
- Reports of the Water Commissioners and George H. Corliss relative to pumping Engines for the Water Works. Providence, 1873.
- Communication from George H. Corliss in Review of the Reports of the Water Commissioners and Chief Engineer of the Water Works upon the pumping Engine at Hope Station. Providence, 1873.
- Communication from J. Herbert Shedd in Review of the Communication from George H. Corliss upon the pumping Engine at Hope Station. Providence, 1873.
- Final Report of the Water Commissioners of the City of Providence, February 28th, 1874. Providence.
- From Prof. George W. Plympton, Brooklyn, N. Y.:
- On the Harmony of Sound and Form. Paper 9, Vol. IV, Royal Engineers. Lieut. Cole, R. E. Chatham, 1865.
- The Essentials of Geometry, plane and solid, as taught in French and German Schools, with shorter Demonstrations than in Euclid. J. K. Morell. London, 1871.
- From Gen. O. M. Poe, Light House Board, Washington, D. C.:
- Plans and Elevations of Light House, 6 sheets; for Cape Canaveral, Florida, 24 sheets; for Cleveland, Ohio, 3 sheets; and for Sand Island, Alabama, for Spectacle Reef, Lake Huron, for St. Augustine, Florida, each 2 sheets. Washington, 1870-2.
- Plans, Proposals and Specifications for Erection of a first Order Light House at Body's Island, N. C., pamphlet and 21 sheets;—for a fourth Order Iron Light House, to be erected at Calcasieu, La., pamphlet and sheet;—for first Order Light Houses, to be erected on Trinity Shoal and Timbalier, Gulf of Mexico, pamphlet and 23 sheets. Washington, 1871-2.
- Steam Fog Whistle. Details of Apparatus. 5 sheets. Washington, 1871.
- U. S. Light House Board Charts, showing relative Positions of Lights in 1st to 7th L. H. Districts, comprising the Atlantic Coast;—in 13th L. H. District, comprising Coast of Oregon and Washington, and on the Lakes. 13 sheets. Washington, 1871-3.
- From Ernest Pontzen, C. E., Vienna, Austria:
- Tests of the Strength of Steel and Iron, made by Direction of the Minister of Commerce of Prussia. Berlin, 1870. (German.)
- From T. Willis Pratt, C. E., Boston, Mass.:
- Improvement in Steam Boilers. Specification accompanying U. S. Letters Patent, granted T. Willis Pratt.
- From the Railway Association of America, St. Louis, Mo.:
- Memorandum on a proposed Railway Clearing-house for the United States and Canada. St. Louis.
- Proceedings of the Western and Southern Railway Association, Meetings held at St. Louis, January 16th, and at Cleveland, July 9th, 1873. 2 vols.
- Transactions of the Association. 5th Meeting. New York, May 14th and 15th, 1873. St. Louis.
- From W. Milnor Roberts, C. E., New York:
- Report of the Chief Engineer of the unfinished Portion of the Northern Pacific Railroad, made to the President of the Company April 27th, 1874. New York (3 copies).

From Col. Thomas S. Sedgwick, Washington, D. C.:  
Letter from the Secretary of War, transmitting a Report upon Examination of Waters for Extension of the Chesapeake & Ohio Canal to the Ohio River. Washington, 1874.

From J. Herbert Shedd, C. E., Providence, R. I.:  
Report on Sewerage of City of Providence made by the Water Commissioners, as a Committee to construct certain Sewers, transmitting Report made to them by J. Herbert Shedd, Chief Engineer Providence Water Works, Feb'y. 1874. (Copies for distribution.)

From Henry A. Sims, Esq., Philadelphia, Pa.:  
Annual Report of the State Engineer and Surveyor on the Canals of New York, for 1852. Albany.  
Annual Reports of the State Engineer and Surveyor on the Railroad Statistics of New York, for 1852 and 1854. 2 vols. Albany.  
Question of a Harbor of Refuge on the Coast of Lake Huron, discussed by the Inverhuron Harbor Committee. Toronto, 1869.  
Report on the Red River Expedition of 1870. S. J. Dawson. Ottawa.  
Sketch of the proposed Line of overland Railroad through British North America. Alfred Waddington. Ottawa, 1871.

From the Smithsonian Institution, Washington, D. C.:  
List of foreign Correspondents of the Smithsonian Institution, corrected to January, 1872. 2 numbers. Washington.

From E. & F. N. Spon, London and New York:  
Builders' Pocket Book of Prices and Memoranda. W. Young. London, 1873.  
Our Iron-clads and Merchant Ships. E. Gardner Fishbourne. London, 1874.  
Surcharged and different forms of retaining Walls. Jas. S. Tate. London, 1873.  
The A, B, C Telegraphic Code. W. Clauson-Thue. London, 1874.

Treatise on setting out railway Curves. David Livingston. London, 1873.  
Treatise on Watch-Work, past and present. Rev. H. L. Nelthropp. London, 1873.

From the U. S. Coast Survey, Washington, D. C.:  
Report of the Superintendent, showing Progress of Survey for 1870. Washington, 1873.

From D. Van Nostrand, Esq., New York:  
Theory of Arches. Prof. W. Allen. New York, 1874. (2 copies.)

From N. J. Welton, C. E., Waterbury, Conn.:  
Second annual Report of the Board of Water Commissioners of the City of Waterbury, and other Reports. Waterbury, 1869.

From Hon. Diedrich Willers, Jr., Albany, N. Y.:  
Annual Report of the State Engineer and Surveyor of the State of New York, and Tabulations and Deductions from the Reports of the Railroad Corporations for year ending September 30th, 1873. Albany.

#### PURCHASED.

Specifications and Drawings of Patents issued from the U. S. Patent Office for November and December, 1873. 2 vols. Washington.  
Wilson's Business Directory of New York City for 1874-5. New York, 1874.

#### DEPOSITED WITH THE SOCIETY.

West Side Atlas. City of New York, between 8th Avenue and Hudson River, from 59th to 155th Street, showing graphically the existing Condition of all Real Estate,—as regards all public Improvements, with an Appendix giving the Dates of the Confirmation of the Assessment for each Improvement. Croes & Van Winkle. New York, 1873.

### ANNOUNCEMENTS.

**MEETINGS.**—The next regular meeting of the Society will be held Wednesday, July 1st, at 1 o'clock P. M., when a paper by John Avery, C. E., on "Underground Drainage in New York" will be read, and a report on the Sixth Annual Convention of the Society presented.

No regular or stated meetings of the Society will be held in July or August.

The next stated meeting of the Board of Direction will be held on Monday, August 3d, at 2 o'clock P. M., for the transaction of regular business.

**PUMPING ENGINES.**—The committee ap-

pointed April 1st to collect and tabulate statistics relating to the principal pumping engines in use, has issued a circular comprising the chief subjects of inquiry, copies of which will be furnished by Gorham P. Low, Jr., C. E., 9 Pemberton Square, Boston, Mass., or the Secretary.

A description more or less complete of the engine and its performance on special trial and at regular work; why the particular style was adopted, and how far it has filled expectations; with sketches, tracings or photographs and details not specified pertinent to the object of inquiry, are asked for. Persons furnishing information will receive a copy of the report of the committee.

**EXTRA POSTAGE AT LETTER RATES**—That is, three cents per half ounce, is collected by the New York Post Office on all packages of books, pamphlets and other printed matter, author's copy and photographs sent to the Society, which have *any writing* upon the wrapper except the address; otherwise the postage on such is but one cent per two ounces. The name of the sender or the contents of the package must *not* be written on the wrapper, but it may be printed.

**COMMENTS AND DISCUSSIONS**—On the papers published in "Transactions," are solicited from members, whether present at the meetings of the Society or not. They are urged to contribute selections from their note-books and other similar recorded experience, bearing upon the subjects considered; those seek-

ing information are asked to suggest professional topics for discussion.

**PHOTOGRAPHS OF MEMBERS**.—By resolution of the Society, each member has been requested to furnish two photographs of himself, of the usual card size, as a means of promoting social recognition and intercourse. Those who have not complied with this request are specially asked to aid in making the collection complete, by speedily forwarding their photographs, endorsed with autograph and date.

**SPECIMENS OF METALLIC FRACTURES**—A plate illustrating Prof. Thurston's paper on the Mechanical Properties of Materials of Construction, published in May Transactions—is issued to members herewith. It should be bound with the paper, facing page 29.

#### ADMISSIONS TO THE SOCIETY.

June 22d, 1874.....	BARNES PHINEHAS (J.).....	Pittsburgh, Pa.
" 11th, "	.....COOLMAN, DE WITT C.....	Ravenna, Oh.
April 21st, "	.....COX, ABRAHAM B., Jr.....	Rochester, N. Y.
May 20th, "	.....CURTIS, RUSSELL H. (J.).....	New York.
June 11th, "	.....EDGE, GEORGE W.....	Jersey City, N. J.
" " "	.....EMERY, CHARLES E.....	New York.
" 16th, "	.....FALCONNET, EDWARD F.....	Louisville, Ky.
" 20th, "	.....JUDSON, JOHN A.....	Newport, R. I.
April 16th, "	.....LEAVITT, EDWARD D., Jr.....	Philadelphia, Pa.
" 30th, "	.....MERRILL, WILLIAM F.....	Buffalo, N. Y.
May 21st, "	.....MICHAELIS, OTHO E., U.S.A.....	Pittsburgh, Pa.
" 9th, "	.....NEWMAN, ROBERT M.....	New York.
April 11th, "	.....PHILBRICK, EDWARD S.....	Boston, Mass.
" 16th "	.....PRINDLE, FRANKLIN C.....	Philadelphia, Pa.
" " "	.....REEVES, DAVID (J.).....	"
June 20th, "	.....SMITH, JOSEPH S.....	"
April 21st, "	.....WHINERY, SAMUEL (J.).....	Somerset, Ky.



# AMERICAN SOCIETY OF CIVIL ENGINEERS.

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## PROCEEDINGS.

### MINUTES OF MEETINGS.

(Abstract of such as may be of general interest to members.)

#### OF THE SOCIETY.

JUNE 10TH-15TH, 1874.—THE SIXTH ANNUAL CONVENTION was held in New York June 10th and 11th, and followed by an excursion to the Pennsylvania coal fields, June 12th to 15th.

The following were in attendance : Guests of the Society—Messrs. F. A. P. Barnard, President of Columbia College; A. J. Bloor, Secretary of the American Institute of Architects; Benjamin R. Western, Secretary of the Society of Engineers and Associates, George Wilson, Secretary of the Chamber of Commerce, and D. Van Nostrand, of New York; Charles F. Kroeh, Albert R. Leeds and C. W. MacCord, Professors of Stevens' Institute of Technology, of Hoboken, and James K. Ford, of Orange, N. J.; Members—Messrs. John F. Fanning, of Manchester, N. H.; W. S. Barbour, Joseph P. Davis, S. Clarence Ellis, James H. Harlow and Clemens Herschel, of Boston; Stephen Holman, of Holyoke; Charles E. Fogg, of Lee; Oliver E. Cushing, of Lowell; Emory C. Davis, of Northampton; Charles D. Elliot, of Somerville; David W. Cunningham, of South Framingham; and A. D. Briggs, of Springfield, Mass.; J. Herbert Shedd and Charles H. Swan, of Providence; Henry Harding and George H. Norman, of Newport; R. I.; Hezekiah Bissell, of East Windsor; Theodore G. Ellis and Charles B. Richards, of Hartford, and N. J. Welton, of Waterbury, Conn.; Charles H. Fisher, Charles Hilton, Squire Whipple and Arthur S. C. Wurtele, of Albany; Julius W. Adams, James H. Armington, Francis Collingwood, Wilson Crosby, Richard D. Dodge, John B. Duncklee, James How, Warren E. Hill, Thomas P. Kinsley, Charles C. Martin, Ralph G. Packard, George W. Plympton, Samuel R. Probasco, Thomas F. Rowland, Lucius A. Smith, Ira N. Stanley and Robert Van Buren, of Brooklyn; Robert N. Brown, T. Guilford Smith and Oscar F. Whitford, of Buffalo; James P. Gould, of Delhi; William B. Coffin, of Elmira; George S. Greene, Jr., of Mott Haven; James C. Aldrich, John G. Barnard, Arthur Beckwith, Leonard F. Beckwith, John Bogart, Alfred P. Böller, Richard H. Buel, Jacob M.

Clark, Isaac D. Colman, Robert L. Cooke, J. James R. Croes, Russell H. Curtis, P. P. Dickenson, Charles E. Emery, Walton W. Evans, Arthur L. Ford, M. N. Forney, William H. Grant, Quincy A. Gillmore, George S. Greene, Charles M. Harris, Charles H. Haswell, Robert G. Hatfield, D. S. Hines, Gabriel Leverich, Charles Macdonald, William W. MacLay, James O. Morse, Robert M. Newman, Louis Nickerson, W. Milnor Roberts, William H. Searles, McRee Swift, John D. Van Buren, Jr., Edward B. Van Winkle and William E. Worthen, of New York; R. Willard Ware, of Port Jervis; Cady Staley, of Schenectady; David M. Greene, of Troy; H. Wadsworth Clarke and William B. Cogswell, of Syracuse, and William W. Wilson, of Yonkers, N. Y.; Cook Talcott and William J. Taylor, of High Bridge; Charles B. Brush, Arthur Spielmann, Robert H. Thurston and DeVolson Wood, of Hoboken; Nathan W. Condict, Jr., Levi W. Post, John F. Ward and Lebbens B. Ward, of Jersey City; Ashbel Welch, of Lambertville; James Owen, of Newark; Horatio Allen, of South Orange, and Clark Fisher, of Trenton, N. J.; C. S. Maurice, of Athens; Calvin E. Brodhead, H. Stanley Goodwin and Charles McMillan, of Bethlehem; Edward N. Beebout, of Erie; Thomas S. McNair, of Hazelton; Adolphus Bonzano, of Phoenixville; Thomas C. Clarke, S. T. Fuller, Frederick Graff, E. D. Leavitt, Jr., and Franklin C. Prindle, of Philadelphia; Phineas Barnes, William H. Kennedy, Gorham P. Low, Jr., and Otho E. Michaelis, of Pittsburgh; J. Dutton Steele, of Pottstown; James Archbald, of Scranton, and Martin Coryell and Frederick Mercur, of Wilkes Barre, Penn.; William R. Hutton and Charles H. Latrobe, of Baltimore, Md.; Orlando M. Poe, of Washington, D. C.; Charles S. Emaek, of Culpeper; E. N. Kirk Talcott, of Glenwood, and John G. Clarke, of Richmond, Va.; Frederick C. Weir, of Cincinnati; M. J. Becker, of Columbus, and William H. Wiley, of Zanesville, O.; E. S. Chesbrough, A. Gottlieb, Max Hjortsberg and W. Sooy Smith, of Chicago, Ill.; Willard S. Pope, of Detroit, Mich.; Morris S. Belknap, William R. Belknap, Charles Herman, John MacLeod, I. M. St. John and Edwin Thacher, of Louisville, and Harvey R. Weeks, of Somerset, Ky.; Theodore Cooper and Thomas J. Whitman, of St. Louis, Mo., and L. F. Olney, of Junction City, Kansas.

The formal sessions of the Convention were held in Tammany Hall, June 10th, as a special meetings of the Society.

THE FIRST AND MORNING SESSION was called to order at 11 o'clock A.M. by the President, who spoke as follows:

It is my very pleasant duty to welcome you to this city, and to the head-quarters of our Society, on this the Sixth Annual Convention.

In view of the amount of more interesting matter provided for your entertainment, I shall not detain you further than to remark that whatever of business may appear to have drawn us together—and by the programme in the your hands this is characterized as “a special meeting for the reading of papers, submission of reports, discussion of profes-

sional subjects and any recommendation for the future action of the Society"—yet the chief purpose and end of our Convention, unlike most gatherings known by this name, is to promote social union among the members of the Society. The business which you will be called upon to transact, will doubtless be of an interesting character, but in its details and results it will reach you in print, and such of our members as may not be with us will thus profit by any professional improvement which may be here developed; but they will lose the hand-shaking, the personal interchange of the sentiment of fellowship and brotherhood, the knowledge of each other, that basis of true *esprit du corps*, which is the life and soul of a society like this. It has been observed that immediately subsequent to each Annual Convention, a marked increase of interest is manifested in the Society, both by its members and the profession generally; and it is hoped that in this respect the present occasion will prove no exception.

The President suggested that the Convention proceed to elect a presiding officer, and, on motion, he was made the permanent Chairman. The order of business was announced.

The Committee appointed January 8th, 1873, to determine "the best form of standard rail sections of this country; the proportion which the weight of rails should bear to the maximum loads carried on a single pair of wheels of locomotives or cars; the best methods of manufacturing and testing rails; the endurance or, as it is called, the 'life' of rails; the causes of the breaking of rails, and the most effective way of preventing it, and the experience of railways in this country in the use of steel rails," made a Report by Mr. Ashbel Welch, Chairman,† which was followed by the reading of a Memoir embodying his personal experience in the use of rails. After discussion by Messrs. Horatio Allen, Cooke, J. Dutton Steele and A. D. Briggs, the Report was accepted, and the Committee continued.

The Convention adjourned for one half-hour.

THE AFTERNOON SESSION was called to order at 1½ o'clock P.M.; at the request of the President, Mr. George S. Greene occupied the chair.

The Committee appointed May 20th, "to examine and report upon the failure of the dam on Mill River, not only to determine who were in fault, but also to assert the existence of the Society, as a body which purposes to exhibit to public notice the true causes of the failure of public works, as well as the engineering ability of those engaged in their construction," made a report, by Mr. Theodore G. Ellis, member of the Committee.\* After discussion by Mr. Worthen, who gave a description of

\* As adopted by the Board of Direction, March 30th, 1874.

† The Committee consists of Messrs. Ashbel Welch, of Lambertville, N. J., M. N. Forney and Octave Chanute, of New York, and I. M. St. John, of Louisville, Ky.

‡ The Committee consisted of Messrs. James B. Francis, of Lowell, Mass.; Theodore G. Ellis, of Hartford, Conn., and William E. Worthen, of New York.

the dam before and after the failure, illustrated by a model in clay, the Report was adopted, and the Committee discharged, with thanks.

The committee appointed at the Fifth Annual Convention, "in view of the calamitous disaster of the falling of the bridge at Dixon, Ill., and other casualties of a similar character that have occurred and are constantly occurring," to report "the most practicable means of averting such accidents," verbally reported progress, by Mr. Alfred P. Boller, member of the Committee.\* The Committee was continued.

The Committee appointed at the Fourth Annual Convention, "to urge upon the United States Government the importance of a thorough and complete series of tests upon American iron and steel, and the great value of formulas to be deduced from such experiments," made verbal report, by Mr. W. Sooy Smith, Chairman, which was followed by the reading of a Memorial for presentation to Congress, and a brief discussion. The Memorial was adopted, the Committee continued, and at the request of the Chairman, Messrs. Robert H. Thurston, of Hoboken, N. J., Charles B. Richards, of Hartford, Conn., and Otho E. Michaelis, of Pittsburgh, Pa., were added thereto.†

Proceedings for the following day were announced; the members, by invitation of the Trustees, would meet at Stevens' Institute, Hoboken, at 10½ o'clock A.M., make a tour of inspection of the apparatus and buildings, under the escort of the Faculty; leave at 12 o'clock M. for Stevens' Battery, partake of lunch there, and at 1½ o'clock P.M., take steamer for excursion in New York bay, and visit to the Battery sea wall, the piers of East River bridge, and the submarine works at Hell Gate, to reach Harlem at 5½ o'clock P.M., and by a special train over the Fourth Avenue Improvement for Grand Central Depot, return to Tammany Hall in time for the annual dinner at 8 o'clock P.M. A programme of the excursion to the Pennsylvania Coal Fields, to leave New York the second day, was distributed.

Papers were read as follows: on "Resistance of Beams to Flexure," by Mr. John G. Barnard, discussed by Mr. Wood; on "Draw Bridge Spans and their Turn-Tables," by Mr. C. Shaler Smith, discussed by Messrs. Herschel and Macdonald; on the "Foundation of the Brooklyn Anchorage of the East River Bridge," by Mr. Francis Collingwood; on "The Conflagration now existing in the Coal at the Kidder Slope," by Mr. Martin Coryell, discussed by Messrs. J. Dutton Steele and Cooke; and on "The Teredo Navalis," by Mr. G. W. R. Bayley.

The Convention adjourned to meet at 8 o'clock P.M.

\* The Committee consists of James B. Eads and C. Shaler Smith, of St. Louis, Mo.; I. M. St. John, of Louisville, Ky.; Thomas C. Clarke, of Philadelphia, Pa.; James Owen, of Newark, N. J.; Alfred P. Boller, Octave Chanute and Charles Macdonald of New York; Julius W. Adams, of Brooklyn, N. Y., and Theodore G. Ellis, of Hartford, Conn.

† The Committee consists of Messrs. W. Sooy Smith, of Chicago, Ill.; John G. Barnard and George B. McClellan, of New York; James B. Eads, of St. Louis, Mo.; Albert Fink, of Louisville, Ky.; Robert H. Thurston, of Hoboken, N. J.; Charles B. Richards, of Hartford, Conn., and Otho E. Michaelis, of Pittsburgh, Pa.

THE EVENING SESSION was called to order at 8 o'clock; the President in the chair.

Papers were read as follows; on the "Improvements of the Water Front of New York," by Mr. John D. Van Buren, Jr., discussed by Messrs. Welch, J. Dutton Steele, Adams, Collingwood and Van Buren; on the "Utica Lift Draw Bridge," by Mr. Squire Whipple, discussed by Messrs. Adams and Welch; on "Upright Arched Bridges," by Mr. James B. Eads, discussed by Messrs. Macdonald, J. Dutton Steele and Welch, and on the "Education of Civil Engineers," by Mr. Thomas C. Clarke. Mr. Barnard continued the discussion on his paper read in the afternoon session, and was followed by Mr. Thurston.

Papers were presented, but not read for lack of time, as follows: on the "Underground Drainage in New York," by Mr. John Avery; on the "Erection of the Illinois and St. Louis Bridge," by Mr. Theodore Cooper, and on the "Construction of the Williamsburgh Reservoir," by Mr. Emory C. Davis.

The Committee appointed June 3d "to present to the Convention the importance of securing a national recognition of the Society by federal charter or otherwise," made verbal report, by Mr. W. Milnor Roberts, member of the Committee,\* which was discussed by Messrs. Adams and Leverich, and the Committee continued.

The time and place of the next Annual Convention was considered and referred to a Committee, consisting of Messrs. Alfred P. Boller, of New York; W. Sooy Smith, of Chicago, Ill., and G. Leverich, of New York, to obtain and canvass the vote of Members thereon, and report the results at the next Annual Meeting.

Mr. Charles Macdonald called attention of the Convention to the plan for founding a "Testing Laboratory," recently proposed by the Stevens Institute of Technology, and presented to the Society by Mr. Robert H. Thurston.

On motion of Mr. J. Dutton Steele, it was "resolved, that a Committee of three be appointed to enquire into the various systems of signals in use upon the several railways of the United States, and to report at the next Annual Convention, with such recommendations as may seem important." Messrs. J. Dutton Steele, of Pottstown, Pa.; Octave Chanute, of New York, and Charles Fisher, of Albany, N. Y., were appointed such Committee.

The Convention adjourned.

JUNE 17TH, 1874.—A quorum not being present, no stated meeting was held.

JULY 1ST, 1874.—A regular meeting was held at 1½ o'clock P. M.

The death, on June 16th, of Mr. J. Milton Brown, late of Auburn, N.

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\* The Committee consists of the President and Vice-presidents of the Society, Messrs. Julius W. Adams, of Brooklyn, N. Y., W. Milnor Roberts, of New York, and Theodore G. Ellis, of Hartford, Conn.

Y., and Member of the Society, was announced, and Messrs. Oscar F. Whitford and L. F. Olney were appointed a Committee to present a memorial of the deceased.

The late Annual Convention was discussed, and the President and Secretary were appointed a Committee with power, to formally present the thanks of the Society to members of committees, managers of railways and others whose generous efforts contributed to the profitable enjoyment of that occasion.

#### OF THE BOARD OF DIRECTION.

JUNE 1ST, 1874.—A quorum not being present, no stated meeting was held.

JUNE 22D, 1874.—A special meeting was held at 2 $\frac{3}{4}$  o'clock P. M., and proposals for admission to the Society considered.

It was announced that the dies of the Norman medal were complete, and deposited with the Director of the U. S. Mint, Philadelphia, subject to the order of the Society.

A rule was made that henceforth in the records and publications of the Society, titles of members shall not be mentioned, except to designate officers of the Association.

JUNE 29TH, 1874.—No stated meeting was held.

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#### NEW BOOKS ON

### ENGINEERING AND TECHNOLOGY.

Under this head will be announced new books on these and kindred subjects published in English, French and German, which may be professionally useful to members of the Society.

The original titles of foreign books noted here will be furnished, on request.

At the present rates of duty and exchange, the cost of imported books may be estimated in federal money, at one shilling equal to 50 cents.

Architecture, Country. J. Birch. London. 4to. 42s.

Boundary. A Treatise on the Law of—and Fences, including the Rights of Property on the Sea Shore and in lands of public Rivers and other Streams, and the Law of window Lights. Ransom H. Tyler. New York. 8vo. \$6.50.

Drawing. School of Art Drawing Book. Parts 1 and 2. Perspective Drawing. London. 4to. Each 2s. 6d.

Technical Drawing and Design for Students of Architecture and Building. Outline Drawing in elementary working Lines and Problems connected with the laying Down of Drawings; the Describing of the Curves of Scrolls; the Setting out of the working Lines and the Development of the Surfaces of Arches and Groins. London. 4to. 1s. 6d.

Dyeing. A Practical Handbook of—and Calico Printing. William Crooks. London. 8vo. illus. 42s.

Earthwork Mensuration on the Basis of the Prismoidal Formula. Containing a simple and labor-saving Method of obtaining Prismoidal Contents directly from end Areas. Illus. by example, and accompanied by plain Rules for Practical Use. Conway R. Howard, C. E. New York. 8vo. \$1.50.

Tables for calculating Excavation and Embankment of regular and irregular cross Section. E. C. Rice. 4to. St. Louis. 1873.

Fog Signals. Report of Prof. Tyndall upon recent Experiments with regard to fog Signals. Parliamentary Report. London. Illus. 2s.

Geology. Manual of—treating of the Principles of the Science, with special Reference to American Geological History. James D.



- Dana. New rev. ed. New York. 8vo., illus. \$5.00.  
 Lighthouses, Further Correspondence relative to Proposals to substitute Mineral Oils for Colza Oil in Lighthouses. Parliamentary Report. London. 5d.  
 Measurer, The complete—2d ed. with important Additions. Richard Horton. London. 12mo. 5s.  
 Metallurgy, Elements of—A practical Treatise on the Art of extracting Metals from their Ores. J. Arthur Phillips. London. 8vo., illus. 34s.  
 Pyramid, The great—and the Royal Society. London. P. Smyth. London. 8vo. 6d.

- Rainfall, British—1873, or, the Distribution of Rain over the British Isles during the year 1873, as observed at about 1,700 Stations in Great Britain and Ireland. G. J. Symons. London. 8vo, illus. 5s.  
 War, Franco-German, Campaign of 1870-71. The German Artillery in the Battles near Metz. Compiled from the official Reports of the Artillery. Translated by Captain Hollister. London. 8vo, illus. 21s.  
 Water Analysis, 3d ed. J. A. Wanklyn and Ernest T. Chapman. Entirely re-written by J. Alfred Wanklyn. London. 12mo. 5s.  
 Weights and Measures, The Metric System of—J. Pickering Putnam. New York. 8vo. \$0.50.

## LIBRARY AND MUSEUM.

### ADDITIONS IN JUNE, 1874.

NOTE.—Members and others are asked to contribute regularly to the library of the Society, copies of government, municipal, railway, canal and other reports, specifications, profiles, maps, photographs and like matter, making up the record of engineering operations for the past or present, and to inform the Secretary where such may be had. Duplicate copies are desired, for transmission to foreign societies in return for works collected and sent to this library by them; also for exchange with members and others who wish complete sets referring to particular subjects. In order to gather material now considered of but little value, but of great future importance in the history of the public works of this country and a comparison of their economical results, donations are solicited of old reports or pamphlets, which in any way refer to their construction or operation.

### DONATIONS ARE ACKNOWLEDGED AS FOLLOWS:

From the American Institute, New York;  
 Forty-third Exhibition of the American Institute. 1874. New York.

From the Association:  
 Revista de Obras Publicas e Minas publica ção mensal da Associaçao dos Engenheiros civis Portuequizes, for January and February, 1873. Lisbon.

From G. W. R. Bailey, C. E. New Orleans, La.:  
 Supplementary and final Report of a Geological Reconnaissance of the State of Louisiana, 1869. E. W. Hilgard, Ph. D. New Orleans. (2 copies.)

From Phineas Barnes, M. E., Pittsburgh, Pa.:  
 Forms of Construction Accounts. Edgar Thompson Steel Works. Pittsburgh. 1874.

From L. C. Brastow, Esq., Wilkes Barre, Pa.:  
 First Annual Report of the Bureau of Statistics of Labor and Agriculture for 1872-3. Harrisburgh. 1874.

From William B. Cogswell, C. E., Syracuse, N. Y.:  
 Cornell University Machine Shop. Ithaca. 1874.

Report of the Geological Survey of Indiana, made in 1869-72, by E. T. Cox, State Geologist. Indianapolis. 5 vols.

From Francis Collingwood, C. E., Brooklyn, N. Y.:  
 Specifications of Timber Bracing for Brooklyn Anchorage, East River Bridge.

From Martin Coryell, C. E., Wilkes Barre, Pa.:  
 Plans of Lehigh & Wilkes Barre Coal Company's Fire, Kidder's Slope. Wilkes Barre, Pa. 1874.

From J. James R. Croes, C. E., Yonkers, N. Y.:  
 Diagrams illustrating daily Flow of West Branch of Croton River. 5 in number.

From Joseph P. Davis, C. E., Boston, Mass.:  
 Specifications for Iron Draw Bridges on Broadway and Eastern Avenues over Fort Point Channel, for the city of Boston. 1874.

From Richard D. Dodge, C. E., Brooklyn, N. Y.:  
 Report on the effects of the Sea-water and Exposure on the Iron Pile Shafts of the Brandywine Shoal Light House. J. D. Kurtz and M. R. Brown. Washington. 1874. (2 copies.)

From James B. Eads, C. E., St. Louis, Mo.:  
 Report of General Humphreys, Chief of Engineers U. S. A. (Ex. Doc. 220), reviewed by James B. Eads, C. E. 1874. (2 copies.)

From John A. Judson, C. E., Newport, R. I.:  
 Report upon the Decay and Preservation of Timber, with Letter of Maj. Gen. G. A. Gillmore, in Response to Request from office of Chief of Engineers U. S. A., Sept. 9th, 1870, for a Report on the "Creosoting" of Timber. T. J. Cram. Washington. 1871.

- From Sanford Fleming, C. E., Ottawa, Canada :
- Report of Progress on the Exploration and Surveys of the Canadian Pacific Railway to January, 1874. By Sanford Fleming, Engineer in Chief. Ottawa. 2 vols.
- From Charles E. Fowler, C. E., New Haven, Conn. :
- Year Book of the city of New Haven, containing Reports of Departments, Documents, &c., for 1873-4. New Haven.
- From Gen. A. A. Humphreys, Chief of Engineers U. S. A., Washington, D. C. :
- Report upon the Determination of the astronomical Co-ordinates of the primary Stations at Cheyenne and Colorado Springs, made during 1872-3. Washington. 1874.
- From G. Leverich, C. E., New York :
- Experiments on the Friction of Leather Collars on Hydraulic Presses, conducted by John Hick, C. E. London. 1867.
- From E. F. Loiseau, Esq., Mauch Chunk, Pa. :
- A Paper on artificial Fuel, read before the Franklin Institute, January 21st, 1874. E. F. Loiseau. Philadelphia.
- From Naval Observatory, Washington, D. C. :
- Instructions for observing the Transit of Venus, December 8th, 9th, 1874, prepared by the Commissioners authorized by Congress. Washington. 1874.
- From H. V. & H. W. Poor, New York :
- Manual of Railroads of the United States for 1874-5, showing their Mileage, Stocks, Bonds, Cost, Traffic, Earnings, &c., their Rise, Progress, &c., an Analysis of the Debts of the United States and of the several States. H. V. Poor, New York and London. 1874.
- From Samuel R. Probasco, C. E., Brooklyn, N. Y. :
- Railroad Manual, or a brief Exposition of Principles and Deductions applicable in Tracing the Route of a Railroad. S. H. Long, C. E. Baltimore. 1829.
- From F. Rinecker, C. E., Switzerland :
- Profiles of the Swiss Central Railroad. 2 sheets.
- From the Society of Civil Engineers, Paris, France :
- Memoirs and Account of Work of the Society, Jan., Feb. and March, 1874. (French) Paris.
- From R. P. Studley & Co., New York :
- Tables for calculating Excavation and Embankment of regular and irregular cross Section. E. C. Rice. St. Louis. 1873.
- From E. & F. N. Spohn, London and New York :
- Catalogue of Scientific Books, principally relating to Civil and Mechanical Engineering. E. & F. N. Spohn. 1874.
- From D. Van Nostrand, Esq., New York :
- Treatise on Bracing, with its Application to Bridges and other Structures of Wood or Iron. Robert Henry Bow, New York. 1874.
- From Squire Whipple, C. E., Albany, N. Y. :
- The Lift-Draw Bridge, built at Ithaca, N. Y., in 1874, by Squire Whipple. 2 framed photographs.
- From Arthur S. C. Wartele, Jr., C. E., Albany, N. Y. :
- Annual Report of the Superintendent of the Aqueduct at Montreal for year ending January 31st, 1864. (French.) Montreal.
- Annual Report of the Superintendent of the Montreal Water Works for year ending January 31st, 1869. Thomas C. Keefer, Montreal.
- Montreal Water Works. The Reports of Walter Shanley, Thomas C. Keefer, and James B. Francis, reviewed by William Rodder, Montreal, 1869.
- Reports and Estimates for a Ship Canal and Basin from Albany to New Baltimore. By William J. McAlpine and others. Albany, 1853.

\* Inadvertently credited to William J. McAlpine, C. E.

## ANNOUNCEMENTS.

**MEETINGS.**—The next stated meeting of the Board of Direction will be held Monday, August 3d, at 2 o'clock p. m., for the transaction of regular business.

No regular or stated meetings of the Society will be held in July or August.

The next regular meeting of the Society will be held Wednesday, September 2d, at 1 o'clock p. m., when ballots for members will be canvassed, a paper by John Avery, C. E., on "Underground Drainage in New York," read, and a report on the Sixth Annual Convention of the Society presented.

**COMMENTS AND DISCUSSIONS.**—On the papers published in "Transactions," are solicited from members, whether present at the meet-

ings of the Society or not. They are urged to contribute selections from their note-books and other similar recorded experience, bearing upon the subjects considered; those seeking information are asked to suggest professional topics for discussion.

**LYNN WATER WORKS.**—By the courtesy of Mr. William E. Worthen, Chairman of the Board of Engineers on the trials of the Pumping Engine for these works, a copy of their report in a form suitable for binding, is sent to members of the Society with this number of Transactions as a supplement.

It is hoped this precedent may be followed, and reports of engineering works or operations thus distributed among those of the profession who value and will preserve them.

# AMERICAN SOCIETY OF CIVIL ENGINEERS.

## PROCEEDINGS.

### MINUTES OF MEETINGS.

(Abstract of such as may be of general interest to members.)

#### OF THE BOARD OF DIRECTION.

AUGUST 3D, 1874.—A stated meeting was held at 2½ o'clock P. M., proposals for admission to the Society were considered, and routine business transacted.

### REPORT AND MEMORIAL

OF THE COMMITTEE ON

### TESTS OF AMERICAN IRON AND STEEL,

PRESENTED AT THE SIXTH ANNUAL CONVENTION, JUNE 10TH, 1874.

Mr. W. SOOY SMITH said—As Chairman of the Committee appointed "to urge upon the United States Government the importance of a thorough and complete series of tests of American Iron and Steel," I have to make a verbal report of progress; also to ask that the Committee be continued, and its numbers increased by the addition of two or three members, so located as to be readily brought together for conference.

The members of the Committee as it is now constituted, are widely separated; they are busy men, and it has been impossible to hold meetings for consultation. Hence after correspondence with them and an interchange of views with reference to the course to be pursued, it was at last agreed that a Memorial should be drafted, for presentation to Congress, urging the importance of these tests and the advantages to be derived from them. Such, embodying the views of the Committee, so far as I have been able to obtain them, has been prepared, and is herewith presented.

I respectfully ask for it the endorsement of the Society.\*

MEMORIAL: To the Honorable, the Senate and House of Representatives of the United States of America, in Congress assembled:—

The undersigned respectfully represent that they are members of a Committee duly appointed, in accordance with the following resolution, passed by the American Society of Civil Engineers, in Convention assembled at Chicago, Illinois, June 6th, 1872.

"Whereas, American engineers are now mainly dependent upon formulae for the calculation of the strength of different forms of iron and steel, not based on experiments upon American materials and manufacture; and

"Whereas, these differ greatly in many of their characteristics from those of foreign

\* On motion, the Committee was increased and the Memorial adopted. See Proceedings of the Sixth Annual Convention, page 110.

production, both in their nature and forms : therefore

"Resolved, that a Committee of five be appointed to urge upon the United States Government the importance of a thorough and complete series of tests of American iron and steel, and the great value of formulae to be deduced from such experiments."

Your Memorialists, in the discharge of the duty imposed upon them by the foregoing resolution, would respectfully set forth facts and considerations in relation to the uncertainties connected with the manufacture and use of iron and steel in the United States, as follows, from which it is earnestly hoped, that the importance of the experiments proposed, and the value of the formulae to be deduced from them, may be apparent.

Iron and steel are now used for so many purposes, which they serve so much better than any other available materials, that not only the comfort and convenience of the people—but the safety of life and property depends greatly on a correct knowledge, and a proper use of them. So intimately are these metals associated with nearly all the most valuable industries, that their consumption by a community has become at once a means and a measure of its civilization.

As the uses of iron and steel have multiplied and extended, so also have the processes by which they are made and wrought become more varied and intricate, and the forms they are caused to assume, more numerous and complex. Many of these forms and processes are new; the results in this country have not been so tested and reported as to give the mechanic, the architect and the engineer the accurate knowledge of strength and other characteristics which is indispensable to judicious use. The variation in quality of these materials, as made and sold, is due to so many causes, that only an exhaustive series of experiments can determine the different characteristics and reveal the conditions which produce them.

Among the most obvious of these causes may be mentioned, the kinds and mixtures of the ores and fuel employed and the different methods of their treatment in the production of pig-metal. These in the United States are unlike those of other iron producing countries. The products of the several methods of making iron and steel also, differ in their qualities. But it is only where iron and steel have been wrought into shapes required in actual use, that the peculiar characteristics of each are fixed and established. They are melted, cast, hammered and rolled, chilled, tempered, case hardened and an-

nealed—welded, upset, drawn, bent and twisted, planed, turned, drilled, sheared, punched and riveted, and are otherwise variously tortured in the process of manufacture and use; they are worked into a great variety of shapes and dimensions, instanced by the finest needle and the enormous shafts and bed-plates of the largest marine engines.

Yet, strange as it may appear, American engineers, architects, manufacturers and mechanics, are dependent for the calculation of the strength of iron and steel in most of the forms used, on English formulae, deduced from experiments upon English materials exclusively, although it is well known that domestic iron and steel, as actually employed, differ so greatly from foreign, that such formulae give, at best, but rudely approximate results.

In the United States, no comprehensive series of tests have been made, or rules determined, by a competent and disinterested authority which can be accepted without caution in computing the strength of these American materials. Therefore it is not strange that accidents resulting from the breaking of parts of machinery, the failure of bridges, or the fall of buildings constantly take place, sometimes with great loss of life and property. It is more remarkable that such are not more common.

No one individual or company can well afford to provide the expensive machinery required to test the parts of iron structures of full size, and if the machinery were supplied, these parts are too costly for individuals or companies to destroy in making tests, and the statements of results thus obtained would not be received with entire confidence. Often from the behavior of small pieces under test, an analogy is traced and accepted, which may or may not exist. In certain cases, manufacturing companies do test pieces of the full sizes used. Valuable experiments are also sometimes made by individuals or corporations preparatory to the erection of very important works.

Such tests of iron and steel have been made by the Engineer and Ordnance Corps of the United States Army, which, by the accomplished officers of these corps are usually in progress; the value of the results obtained is recognized and appreciated, but the means employed in the varied and disconnected efforts are inadequate, and the facts developed and rules derived from them have not been so collated and reduced as to be accessible to the general public.

Your Memorialists would further respectfully set forth, that it will require a very considerable expenditure of money to provide a

place and machinery suitable to make an exhaustive set of tests of American iron and steel and of other materials, as stone and wood, which enter largely into construction. The services of able, scientific and practical men will be required, and years of time must be spent by them in the investigations now so urgently needed.

In most of the iron producing countries of the world, tests more or less thorough, of the qualities of iron and steel there produced have been made—so that not only are the people of each country well advised as to the correct use of their materials, but the qualities of such are, at the same time, made known throughout the world, and thereby, in every instance, the national wealth has been largely augmented.

The Commission appointed in 1847, by the British Government, to inquire into the application of iron to railway structures, spent two years in investigation, and made a report which ever since has been the basis of practice in the use of iron for railway purposes, not only in England, but almost in the whole civilized world. In France, the government has shown marked interest in encouraging engineers, manufacturers and other to test all materials that enter into construction, by permitting such tests to be made at national cost at the various schools of instruction, which are supported by the state. The value of these impartial examinations into the strength

and constituents of materials officially certified to, cannot be over-estimated. The various tables of strength of materials by Mons. Tresca and others are well known. In other countries on the continent of Europe, much, from time to time, has been done in this direction under government supervision or by state aid—though not so regularly as in France.

In countries where such thorough investigations have been made, and the results given to the public—any great mistakes in the application of the materials tested are without excuse. But in the United States, through want of the precise knowledge which the experiments will develop that your Memorialists earnestly ask shall be made, even natural constructive talent, of a high order, is frequently at fault, and the result is either excess and consequent waste of material, or, what is still more disastrous, weakness in parts where strength is essential.

It is more than probable that our government itself, as a large consumer of iron and steel, wastes in over-sizes and ill-proportioned forms, enough iron and steel annually to defray the entire expenses of the investigations asked; while it is not at all certain that public buildings and machinery are as safe as they might be made at less expense, with the thorough knowledge of the materials employed in their construction, which your Memorialists respectfully urge it to be the duty of the government to obtain.

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## NOTES AND MEMORANDA.

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Members are desired to contribute selections from their note books and similar records of experience referring to engineering practice, and those seeking information are asked to suggest professional topics for discussion.

**PRACTICAL QUESTIONS IN BRIDGE CONSTRUCTION.**—Allow me to submit a few practical questions which frequently arise in the experience of every constructive engineer. Upon most of these questions, books—at least so far as my library extends—have but little to say, and practice widely differs.

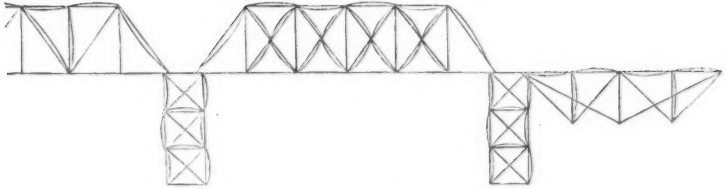
1st. In what condition should the various thrust members of bridges, roofs and trestles be considered; or which of the three conditions upon which we have any experimental knowledge, do the columns in actual practice most nearly approach?

Specifications are frequently made requir-

ing the formulae of a certain author or experimenter to be used, but fail to specify the conditions under which they shall be applied; the consequence is, each engineer exercises his own judgment, and in these days of close competition, it would not be surprising if the benefit of a doubt is sometimes thrown on the side of cheapness. In order to ensure fair competition, some standard should be adopted and required by specifications in all competitive work.

Is not every thrust member of a bridge—without it be those resting directly on foundations—in a hinged condition at both ends

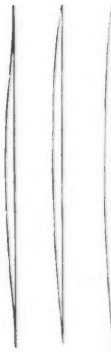
Fig. 1.



or worse? See Fig. 1. So far as I can learn it seems to be the practice of English engineers to so consider them.\*

It has been found by experiment, that a column when flat at both ends is deflected as in *A*, Fig. 2; when flat at one end and hinged

Fig. 2.  
*A*, *B*, *C*.



at the other, as in *B*, and as in *C*, whence knowing its deflection we can determine its condition, and as a column will always assume that form which meets with the least resistance—assuming workmanship to be perfect—will not “end braces” and “lower sections of piers or trestles” assume the form given by *B*; and all other parts that given by *C*, as indicated by the curved lines. But as perfect workmanship is not always a certainty, and as both theoretically and experimentally a column upon which the pressure is not uniformly

Fig. 3. distributed, nor Fig. 4.



through the axis, but at one side, is much weaker than when hinged at the ends, will not this latter condition be that only which safely may be assumed in any thrust member of a structure subject to vibration and loaded at the joints?

2d. In the chords or braces of a bridge made up of two or more parallel pieces, united by bolts and



separating pieces (Fig. 3), is not great advantage gained by combining, as in Fig. 4, the ends being held by lugs and bolts without keys? If the pieces are truly parallel, each is free to bend the same way, and their united strength is the sum of each taken separately; but if combined, as in Fig. 4, will not the following theory apply?

Let  $W$  = weight on piece *A*, and  $W_1$  on piece *B*;  $d$  = deflection of *A*;  $c$  = united deflections of *A* and *B*. The tension on bolt at *C* due to

$$W = \frac{4d}{l} W,$$

and to

$$W_1 = \frac{4(c-d)}{l} W_1;$$

but if the brace at *C* be in equilibrium,

$$\frac{4d}{l} W = \frac{4(c-d)}{l} W_1,$$

or

$$d = \frac{c W}{W + W_1}.$$

Making  $W = W_1$ ,  $d = \frac{c}{2}$ , or the deflections are equal; making  $W = 0$ , or whole weight on *B*,  $d = c$ ; making  $W_1 = 0$ , or the whole weight on *A*,  $d = 0$ ; or when the whole weight is concentrated on one point, then, and not until then, can the equilibrium at *C* be destroyed, or the posts act independently of each other.

3d. Why is it that a bridge cross-tie notched down as at *A*, Fig. 5, will almost invariably

Fig 5.



split following the grain, while if beveled, as at *B*, it will not split. Observation and experience seem to establish the fact that it is so, but I knew of no sufficient theoretical reason why it should be?

4th. In bridge chords, floor beams or other members supported at the ends, and subjected to tension or compression, combined with transverse strain, is not great advantage gained by placing the pin out of

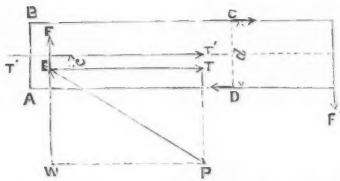
\* See “Rankin’s Civil Engineering,” 4th edition, Art. 378, page 562, and Art. 381, page 570; also “Stoney’s Theory of Strains in Girders,” Vol. II, Art. 339, page 223.



centre? So far as I can learn, there are no authorities on this particular case, without it may be "Weisbach," (who intimates that no advantage is gained, though he fails to prove it.) I have investigated the subject, and arrived at certain conclusions, which I submit for criticism, as the principle has a very important bearing on the cost and strength of bridge work.

As the strains in a beam due to a transverse load are well understood, or at least uniformly treated, we will neglect this part of the load, and consider only the following problem. To find the strains in the flanges of a beam due to a diagonal force  $P$ , applied outside of the neutral axis, the beam being supported at the ends. Any segment  $A, B, C, D$ , of the beam, Fig. 6, is held in equilibrium by

Fig. 6.



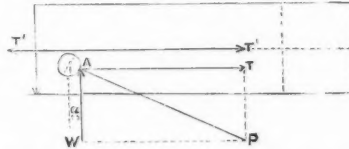
the force  $P$ , the reaction at the point of support  $W$ , and the elastic forces in the section  $C, D$ . But if the forces at  $E$  are in equilibrium, the horizontal force  $T$  is the resultant of the forces  $P$  and  $W$ , and the moment of  $T$  is equal to the sum of the moments of those forces. This force then is in equilibrium with the elastic forces in the section  $C, D$ . But the horizontal forces at  $C$  and  $D$  due to the bending part of the force  $T$ , are equal and opposite, forming a couple, and as no finite force with a finite arm can hold a couple in equilibrium, the resultant  $T$  can be replaced by the force  $T'$  through the axis, and the couple  $T-T'$ , and these couples must be in equilibrium, or  $Tc = Cd = Dd$ ; but  $Cd$  is the moment of the horizontal forces tending to produce rupture, whence it may be replaced by  $\frac{fI}{t}$ , in which  $f$  = strain persquare inch in the outer fibre,  $I$  = moment of inertia, and  $t$  = distance from neutral axis to outer fibre. Whence  $Tc = \frac{fI}{t}$

or,  $f = \frac{Tct}{I}$ . The strain per square inch due to force  $T' = T$  through the axis  $= \frac{A}{T}$ ,  $A$  being the area of section, and the total strain in either flange becomes  $\frac{Tct}{I} \pm \frac{A}{T}$ . The external forces  $P - P'$  form a couple in equilibrium with  $T - T'$ , allowing the couple  $U - D$  in the flange to act.

5th. Does not this force act throughout the chord, whatever may be the number of panels? As the effect is uniform for all sections, I can see no reason why it should not.

6th. Allowing the foregoing reasoning to be correct, at what point of the pin, in structures with pin connections, does the resolution of forces take place? See Fig. 7.

Fig. 7.



It is a fundamental principle of mechanics, that if three forces are in equilibrium, two of which pass through a certain point, the third must pass through the same point. The force  $T$  can be applied at no other point than  $A$ . The force  $P$  passes through that point, whence the reaction  $W$  must also pass through  $A$ ; or if the forces  $W$  and  $P$  intersect at the centre of the pin, the force  $T$  being applied at  $A$ , a couple whose moment is  $Wa$  will be formed, throwing a bending strain

into the flange, of  $\frac{Wa}{I}$  in a contrary direction from the couple  $T - T'$ . In order that these forces may balance each other  $\frac{Tct}{I} = \frac{Wa}{I}$

or  $a = \frac{Tc}{W}$ , whence by placing the point of reaction at a distance from  $A = \frac{Tc}{W}$ , the effect of the pin being out of centre is overcome.

Questions like these frequently occur in practice; doubtless much good would result from a discussion of them by the Society or individual members.

EDWIN THACHER, C. E.

## ENGINEERING AND TECHNOLOGY.

Under this head will be announced new books on these and kindred subjects published in English, French and German, which may be professionally useful to members of the Society.

The original titles of foreign books noted here will be furnished, on request.

At the present rates of duty and exchange, the cost of imported books may be estimated in federal money, at one franc equal to 37 cents.

Chemistry, Six short Lectures on experimental—; introductory to the general Course. J. Emerson Reynolds. 8vo. Dublin. \$1.75.

Geology, Manual of—; treating of the Principles of the Science with special Reference to American Geological History. James D. Dana. New rev. ed. New York. 8vo. illus. \$5.00.

House Owner's Estimator; or, what it will Cost to build, alter or repair? Jas. D. Simon; ed. and rev. by F. T. W. Miller. London. 12mo. \$1.75.

Iron and Coal, also articles on the Krupp Gun and the "Familliere" of Guise. Louis Reybaud. Paris (French). 8vo. \$3.00.

Laud, On the Reclamation and Protection of agricultural—. David Stevenson. Edinburgh. 8vo. \$2.25.

Locomotives, Notes on the Adhesion of—. M. J. Moschell. Paris (French). 8vo. 11.

Mining Industry of the States and Territories of the Rocky Mountains, including Descrip-

tions of quartz, placer and hydraulic Mining; Amalgamation; Concentration; Smelting, etc. Rossiter W. Raymond, U. S. Com. of Mining Statistics, etc. New York. 8vo. illus. \$4.50.

Painting, Practical Treatise on the Manufacture of Colors for—. MM. Riffault, Vergnaud and Toussaint. Rev. and ed. by M. F. Malepeyre. Trans. by A. A. Pesquet. Philadelphia. 8vo. \$7.50.

Ornamentor, Modern—and interior Decorations. A. P. Boyce. Boston, oblong. \$3.50.

Petroleum, Notes on the combustion of the Oils and Essences of—. Paris (French). 8vo. illus. 4f.

Notes on obtaining, extracting and refining of—, and the application of its derived Products. Paris (French). 12mo. 11f.

Year Book of Facts in Science and Art; exhibiting the most important Discoveries and Improvements of the past Year. John Timbs. London. 12mo. \$2.50.

## LIBRARY AND MUSEUM.

## ADDITIONS IN JUNE, 1874.

Note.—Members and others are asked to contribute regularly to the library of the Society, copies of government, municipal, railway, canal and other reports, specifications, profiles, maps, photographs and like matter, making up the record of engineering operations for the past or present, and to inform the Secretary where such may be had. Duplicate copies are desired, for transmission to foreign societies in return for works collected and sent to this library by them; also for exchange with members and others who wish complete sets referring to particular subjects. In order to gather material now considered of but little value, but of great future importance in the history of the public works of this country and a comparison of their economical results, donations are solicited of old reports or pamphlets, which in any way refer to their construction or operation.

## DONATIONS ARE ACKNOWLEDGED AS FOLLOWS:

From the Austrian Society of Engineers and Architects, Vienna, Austria:  
Gazette of the Society Nos. III.—IX. (German) Vienna. 1874.

From Phineas Barnes, C. E., Pittsburgh, Pa.:  
Parliamentary Report on Steam Boiler Explosions—with Index—2 vols. London. 1870.

— on Accidents on Railways in 1870. London. 1871.

—; Railway Trains. London. 1865.

From William H. Boardman, Esq., New York:  
Cost of Transportation on Railroads. L. P. Morehouse. New York. 1874.

From the Civil Engineer's Club of the Northwest, Chicago, Ill.  
Papers and Proceedings as follows:  
Conveyance of Water across Navigable Streams. E. S. Chesbrough. 1874.  
Cost of Transportation on Railroads. L. P. Morehouse. 1874.  
Leveeing on the Upper Mississippi. E. L. Corthell. 1874.

Preliminary Surveys for the Texas Pacific Railroad. C. W. Durham. 1874.  
Proceedings of the 5th Annual Meeting—June 8th, 1874.

Test Borings and a Tool for making Them. E. C. Clarke. 1874.

From the Clerk of the House of Representatives, Washington, D. C. 43d Congress, House of Representatives. Report, No. 612.

Geographical and Geological Surveys West of the Mississippi. Washington. 1874.

From F. Collingwood, C. E., Brooklyn, N. Y.:

Reports of the Executive Committee, Chief Engineer and Treasurer of the New York Bridge Co. Brooklyn, 1874.

From James W. Conner, Esq., Philadelphia, Pa.:

Concave Caulking for Steam Boilers, Iron Ships, Tanks and other metallic Vessels. Philadelphia. 1874.

From Theodore Cooper, C. E., St. Louis, Mo.:

Photographic Views of the Illinois and St. Louis Bridge across the Mississippi River, in Process of Erection (six in number). St. Louis. 1874.

From Elias Ebert, Esq., Zanesville, O.:

Annual Report of the Trustees of the Water Works of Zanesville, O., for 1873-4. 2 vols. Zanesville, O. 1873-4.

From S. N. Felton, Jr., C. E. Philadelphia, Pa.:

Bessamer Process and Works in the United States. New York. 1868.

Letter of John D. Perry, Pres. Union Pacific Railway, with Reports of the Engineer and Geologist. Philadelphia. 1868.

Twenty-seventh Annual Report of the Pennsylvania R. R. Co. Philadelphia. 1874.

From A. Fink, C. E., Louisville, Ky.:

Annual Report of the Louisville & Nashville R. R. Co., 1872-3. Louisville, 1874.

From Gen. A. Gillmore, New York.:

Ordnance Memoranda, No. 17. Report of the Board of Officers on Gatling Guns of large Calibre for Flank Defence. Washington. 1874.

From William H. Grant, C. E., New York.:

Topographical Map, made from Surveys of the Department of Public Parks of New York, of that part of Westchester County, adjacent to the City. New York. 1873.

From Gen. A. A. Humphreys, Chief of Engineers, U. S. A., Washington, D. C.:

Report of a Reconnaissance in the Ute Country in 1873, by Lieut. E. H. Ruffner, Washington. 1874.

Reports upon the Fort St. Philip Canal and Construction of Jetties for the Improvement of the Mouths of the Mississippi, with Maps. Washington. 1874.

From G. Leverich, C. E., New York.:

Letter of Norman Wiard, Esq., proposing Experiments in Ordnance, and for making and testing new Guns of large Calibre. Washington. 1874.

From Hon. M. D. Leggett, Commissioner of Patents, Washington, D. C.:

General Index of the Official Gazette, and Monthly Volumes of Patents of the United States Patent Office, from January to December, 1873. Washington. 1874.

From F. Moberly, C. E., Ottawa, Can.:

Report of Progress on the Explorations and Surveys of the Canadian Pacific Railway to January, 1874. 2 vols. Ottawa, 1874.

From Messrs. George M. Mowbray and A. W. Despard, Esq., New York:

Tri-nitro Glycerine, as applied in the Hoosac Tunnel, to submarine Blasting. Quarrying, Torpedoes, &c. George M. Mowbray, New York, 1874.

From Charles E. Paine, C. E., Providence, R. I.:

Report upon the National Convention of Chief Engineers of Fire Departments, held in Baltimore, October, 1873. Providence, 1874.

Reports of the Water Commissioners and George H. Corliss, on pumping Engines for the Water Works. Providence, 1873.

Communications from George H. Corliss on Reports of the Water Commissioners and Engineer upon pumping Engine at Hope Station, and from J. Herbert Shedd, in review of same. 2 vols. Providence, 1873.

Special Report of Water Commissioners on Foundations, Buildings and Plans for pumping Engines at Pettaconset Station. Providence, 1873.

From Prof. George W. Plympton, Brooklyn, N. Y.:

On Cleaning, and Freeing from Water the City of Berlin. (German.) 2 vols. Berlin, 1861.

From Gen. O. M. Poe, Light-house Board, Washington, D. C.:

U. S. Light-house Establishment. Drawings and Specifications of Wooden and Iron Buoys, Lamps, Light-keeper's Implements, &c. Plates 1 to 87.

Manuel of Light-house Engineering, embracing Plans of Towers, Light Vessels, Beacons, Buoys, and other Aids to Navigation. Vol. II, plates, Washington, 1869.

From Ernest Pontzen, C. E., Vienna, Austria:

The Channel Railroad Ferry between England and the Continent—proposed by Th. Obach and B. Lebrecht. London, 1874.

From the Saxonian Society of Engineers and Architects, Saxony:

Proceedings of the 81st regular and general Meeting on Dec. 7th, 1873, at the University of Leipzig. (German.) Dresden, 1874.

From Col. Thomas S. Sedgwick, Washington, D. C.:

Report in Relation to the Extension of the Chesapeake & Ohio Canal, by T. S. Sedgwick, C. E. Washington, 1874.

From Harry E. Sharpe, Esq., St. Louis, Mo.:

Revised Constitution of the Railway Association of America.

From T. Guilford Smith, C. E., Buffalo, N. Y.:

Philadelphia & Erie R. R. Co., *et al.* vs. Catawissa R. R., *et al.*; Andrew Scott vs. Atlantic & Great Western Ry. Co., *et al.*, Appellant's case.

Proceedings of the American Association for the Advancement of Science. 20th Meeting, held at Indianapolis, August, 1871. Cambridge, 1872.

Report on the Art of War in Europe in 1854-6. Col. R. Delafield, U. S. A. Washington. — of Explorations and Surveys of Route for a Railroad from the Mississippi river

to the Pacific Ocean, made in 1853-4. Washington, 1856.  
 Report on Mineral Resources of the States and Territories west of the Rocky Mountains. Washington, 1867.

— of the United States, by Commissioners J. Ross Browne and James W. Taylor. Washington, 1867.  
 — of the Railroad Companies of Pennsylvania, January 22d, 1864, Harrisburg.

Report of Rear Admiral Charles H. Davis, on proposed Lines for interoceanic Canals, and Railroads between the Atlantic and Pacific Oceans. Washington, 1866.

— of State Engineer and Surveyor of New York, and Reports of the Railroad Corporations for year ending Sept. 30th, 1858. Albany, 1859.

— of the Superintendent of the Coast Survey for 1860. Washington, 1861.

## ANNOUNCEMENTS.

**MEETINGS.**—The next stated meeting of the Board of Direction will be held Monday, August 31st, at 2 o'clock p. m., for the transaction of regular business.

No regular or stated meetings of the Society will be held in August.

The next regular meeting of the Society will be held Wednesday, September 2d, at 1 o'clock p. m., when ballots for members will be canvassed, a paper by John Avery, C. E., on "Underground Drainage in New York," read, and a report on the Sixth Annual Convention of the Society presented.

**COMMENTS AND DISCUSSIONS.**—On the papers published in "Transactions," are solicited from members, whether present at the meetings of the Society or not. They are urged to contribute selections from their note-books and other similar recorded experience, bearing upon the subjects considered; those seeking information are asked to suggest professional topics for discussion.

**PHOTOGRAPHS OF MEMBERS.**—By resolution of the Society, each member has been requested to furnish two photographs of himself, of the usual card size, as a means of promoting social recognition and intercourse. Those who have not complied with this request are specially asked to aid in making the collection complete, by speedily forwarding their photographs, endorsed with autograph and date.

A circular recently issued by the Secretary is here quoted:

**OLD REPORTS.**—There is in the possession

of almost every one connected with this Society a collection of reports, circulars and similar publications, which if arranged and preserved, would in time be invaluable as furnishing the material for a comparison and record of economic results pertaining to the public improvements of this country. The Society proposes to gather this matter (much of which in its present condition is useless rubbish, and therefore day by day thrown away and destroyed), and will assort, bind and preserve it for future reference. You are asked to collect whatever you can spare of such books, pamphlets, circulars, maps and like matter, and send them to the library here, by express or otherwise, at the cost of the Society; the donations, as received, will be acknowledged in the Transactions.

**PROPOSALS OF MEMBERS.**—In the practice of engineering are many of culture and experience not members of the Society, who would confer honor upon it, and as such are admitted, its strength, influence and usefulness will increase. The rate and permanence of this growth very much depends on the individual effort of members—a little labor by each would soon double our numbers. You are solicited to aid in this by presenting the Society and its objects to those known to you in the profession who would be desirable members. For this purpose forms of application for admission are enclosed, and others will be sent as requested.

**RAIL SECTIONS.**—Attention is called to an error in "Contents," 1st page of cover—July Transactions; there was but one plate of "Rail Sections," instead of two, as stated.

# AMERICAN SOCIETY OF CIVIL ENGINEERS.

## PROCEEDINGS.

### MINUTES OF MEETINGS.

(Abstract of such as may be of general interest to members.)

#### OF THE SOCIETY.

SEPTEMBER 3D, 1874.—A regular meeting was held at 1½ o'clock P. M.

The vote on admission to membership was canvassed, and the following declared elected Members.—Messrs. Adna Anderson, of Washington, D. C. ; Elmir L. Corthell, of Louisiana, Mo. ; G. Thomas Hall\*, of Charlton, N. Y. ; John Nader, of Madison, Wis. ; Robert L. Reed, of Indianapolis, Ind. ; Samuel L. Smedley and David McN. Stauffer, of Philadelphia, Pa. ; Eugene Vanderpoel, of Newark, N. J., and Gouverneur K. Warren, Engineer Corps, U. S. A. : and Juniors Addison A. Lindsley, of San Francisco, Cal. ; Alfred Noble, of Sault St. Marie, Mich., and Alfred Walter, of Brooklyn, N. Y.

The death, on July 31st, of Mr. T. Marr Johnson, late of London, England, Member of the Society, was announced, and Messrs. C. Douglas Fox and Christer P. Sandberg were appointed a committee to present a memorial of the deceased.

The Secretary made report on the Sixth Annual Convention, which was accepted and referred to a committee of Messrs. G. Leverich, M. N. Forney and Alfred P. Boller, to report at the next regular meeting.

A report on the Gauge of the New York & Erie Railroad, by the late T. S. Brown, Chief Engineer, was read by Mr. Robert N. Brown, of Buffalo, N. Y., and presented to the Society as a valuable record of one phase of the history of railroads.

Messrs. O. Chanute, M. N. Forney, I. C. Buckhout, Charles K. Graham and Francis Collingwood were appointed a committee to investigate the necessary conditions of success and to recommend plans, for the best means of rapid transit for passengers and the best and cheapest methods of delivering, storing and distributing goods and freight, in and about New York, with instructions to examine plans and to receive suggestions such as parties interested in the matter may choose to offer, and to report to the Society on or about December 1st, 1874.

\* Transferred from Associate to Member.

## OF THE BOARD OF DIRECTION.

AUGUST 31st, 1874.—A stated meeting was held at 2½ o'clock p. m., proposals for admission to the Society were considered and routine business transacted.

## NEW BOOKS ON

## ENGINEERING AND TECHNOLOGY.

Under this head will be announced new books on these and kindred subjects published in English, French and German, which may be professionally useful to members of the Society.

At the present rates of duty and exchange, the cost of imported books may be estimated in federal money, at one shilling equal to 50 cents.

- Agricultural Property and Products of the United States of America in 1840, 1850, 1860, and 1870.—arranged geographically and by Nationalities. Samuel B. Ruggles. New York. 8vo, illus. \$0.50.
- Armed Strength of Austria. Capt. W. S. Cook. Part II. London. 8vo, illus. \$5.75.
- Correlation of physical Forces. 6th ed., with other Contributions to Science. Sir W. G. Grove. London. 8vo, 15s.
- Drawing, National System of Industrial.—Free Hand. No. 3. Bartholomew's. New York. 8vo, oblong. \$0.20.
- Health, Annual Report of the State Board of—of Massachusetts. January, 1874. Boston. 8vo.
- Iron Trade, A new Guide to—Jas. Rose. 2d. ed. London. 8vo. \$4.25.
- Manual of the American Iron Trade, with a Description of the iron Ore Regions, blast Furnaces, rolling Mills, Bessemer Steel Works, crucible Steel Works, Car Wheel and Car Works, Locomotive Works, Steam Engine and Machine Works, Iron Bridge Works, Iron Ship Yards, Pipe and Tube Works, and Stove Foundries of the Country, giving their Location and Capacity of Product. Compiled and edited by Thos. Dunlap. New York. 4to. \$7.50.
- Labor, Fifth Annual Report of the Bureau of Statistics of—. February, 1874. Boston. 8vo.
- Land Improver's Pocket Book, consisting of Formulae, Tables, and Memoranda required in any Computation relating to the permanent Improvement of landed Property. John Ewart. London. Oblong. 4s.
- Light House. Report on Effect of Sea Water and Exposure on the Iron Pile Shalloes of the Brandy Wine Shoal Light House. J. D. Kurtz and M. R. Brown. Washington. 4to.
- Manufacturing Arts in ancient Times. Jas. Napier. London. 12mo. \$3.00.
- Mechanical Engineers. Proceedings of the Institution of—, 30th April. 1874. Birmingham. 8vo.
- Mechanics, Handbook of applied—. Henry Evers. London. 12mo. \$0.75.
- Metallurgy, Manual of—, Wm. Henry Greenwood. New York. 12mo, illus. \$1.50.
- Metropolitan Board of Works. London. Report for the Half Year ending Dec., 1873. London. 1s. 4d.
- Naval Architecture: An elementary Treatise on Wood and Iron Ship Building. Vol. II. Plates. S. J. P. Thearle. London. 4to.
- Nautical Almanac: American Ephemeris and—, Washington. 8vo.
- Patents. General Index of the Official Gazette, and Monthly Volumes of Patents of the U. S. Patent Office, from January to December, 1873. Washington. 8vo.
- Specifications and Drawings of Patents issued from the U. S. Patent Office for January and February, 1874. Washington. 2 vol. 8vo.
- Railroads, Manual of—of the United States for 1874-5, showing their Mileage, Stocks, Bonds, Cost, Traffic, Earnings, &c., their Rise, Progress, &c., with Analysis of the Debts of the United States, and of the several States. H. V. Poor. New York. 8vo. \$5.00.
- Railway. Iron and Timber Railway Superstructures and general Works; giving Dimensions and Quantities for the Standard 4 ft. 8½ in. Gauge and the Metre 3 ft. 8½ in. Gauge; also applicable for light Railways, Steam Tramways, &c. With some earthwork Tables and Outline of a Specification and Requirement. J. W. Grover. London. folio. 42s.
- Tyler's Report on Railway Accidents, 1873. (Parliamentary Report.) London. 1s. 2d.
- Returns for 1873. (Parliamentary Report.) London. 1s. 1d.
- Returns relative to the Interlocking and Concentrating of Signal and Point Levers, &c., and to the Systems upon which the lines of Railway are worked. (Parliamentary Report.) London. 7d.
- Sanitary Subjects, Short Lectures on—, Rich'd J. Halton. London. \$2.50.
- Steam Engines, Improvements in—, John Houpt. Philadelphia. 12mo, tucks. \$2.00.
- Strength of Materials, Theory of—illustrated by Applications to Machines and Buildings. Francis L. Vinton. New York. 8vo, illus. \$3.00.
- Tri-Nitro-Glycerin, as applied in the Hoosac Tunnel, and to submarine Blasting, Torpedoes, Quarrying, &c.; Mica Blasting, Powder, Dynamites; with an Account of the various Systems of Blasting by Electricity, Priming Compounds, Exploders, electrical Machines, &c. George M. Mowbray. 3d ed., re-written. New York. 8vo, illus. \$3.00.
- Water Supply. Horizontal Wells: a new Application of geological Principles to effect the Solution of the Problem of Supplying London with Pure Water. J. Lucas. London. 8vo. 10s. 6d.



## LIBRARY AND MUSEUM.

## ADDITIONS IN AUGUST, 1874.

NOTE.—Members and others are asked to contribute regularly to the library of the Society, copies of government, municipal, railway, canal and other reports, specifications, profiles, maps, photographs and like matter, making up the record of engineering operations for the past or present, and to inform the Secretary where such may be had. Duplicate copies are desired, for transmission to foreign societies in return for works collected and sent to this library by them; also for exchange with members and others who wish complete sets referring to particular subjects. In order to gather material now considered of but little value, but of great future importance in the history of the public works of this country and a comparison of their economical results, donations are solicited of old reports or pamphlets, which in any way refer to their construction or operation.

## DONATIONS ARE ACKNOWLEDGED AS FOLLOWS :

From O. Chanute, New York:  
Mississippi River—Peculiarities of the Physical Geography of—. E. Fontaine. 1874.  
Postal Cars or no Postal Cars. 1874.

—; Railroads vs. Postal Cars, a Letter discussing question of Compensation to Railroads for the Transportation of Mails. G. S. Bangs. Washington. 1874.  
— Service. Relation of the Federal Government to Railroads in respect to—. D. A. Wells. New York. 1874.  
St. Louis. Report on Lowering Tracks of the Missouri Pacific R.R., and connecting all Commercial Outlets of St. Louis. 1874.

From E. S. Chesbrough, Chicago, Ill.:  
Fifteenth Annual Report of the Board of Public Works, City of Chicago. 1874.

From J. H. C. Coffin, Bureau of Navigation, Washington, D. C.:  
Almanac. American Ephemeris and Nautical Almanac for 1877. Washington. 1874.  
Latitude of a Place. Tables for Finding—by Altitudes of Polaris. Washington. 1874.  
Transit of Venus. Instructions for Observing—Washington. 1874.

From John B. Dunklee, Washington, D. C.:  
Specifications for dredging Washington and Georgetown Harbors. 1874.

From William H. Hutton, Baltimore Md.:  
Metals for Cannon. Report of Experiments on the Properties of — and the Qualities of Cannon Powder. T. J. Rodman. Boston. 1861.

— Report of Experiments on the Strength and other Properties of—, with a Description of Machines for Testing Metals, by Officers of the Ordnance Department, U. S. A. Philadelphia. 1856.

From the Institution, Birmingham, England:  
Proceedings; Institution of Mechanical Engineers, 30th April, 1874. Birmingham.

From J. B. Killebrew, Nashville, Tenn.:  
Resources of Tennessee. J. B. Killebrew. Nashville. 1874. (2 copies.)

From Charles H. Myers, New York:  
Third Annual Report Department of Public Works. New York. 1873.

From ———\* Cleveland, O.:  
Bridge. Report of Willard S. Pope, on the Falling of the Bridge at Zanesville, O., December 4, 1866.

\* Donor's name omitted at his request.

Buffalo. Statistics of the Trade and Commerce of—. 1870. Buffalo.

Car Brake. Answer to Memorial for Extension of Tanner Center Lever Car Brake Patent. S. M. Whipple. Washington. 1873.

— Wheel. Answer to Petition for Extension of Anson Atwood's Railroad Car Wheel Patent. S. M. Whipple. Washington. 1873.

Chicago. Reports of Trade and Commerce of—for 1871 and '72. Chicago.

Coal and Iron of Southern Ohio. T. S. Hunt. Salem. 1874.

Geological Survey of Ohio. Report of Progress in 1870. J. S. Newberry. Columbus. 1871.

Locomotive Engine Safety Truck Co. vs. Erie Ry. Co. Opinion of the Court. New York. 1873.

— Engineers. Minutes of Grand International Division of Brotherhood of—at Annual Session, Boston. November, 1866. Rochester.

Locomotive Firemen's Monthly Journal. Schenectady. 1873.

Ohio. Annual Reports of the Secretary of State for 1869 and '71. Columbus. 2 vols.

Railroad. American Railroad Journal. 5 nos. 1852-'53.

Railroads of the United States. Influence of—. New York. 1869.

— Relation of the Federal Government in respect to Postal Service. D. A. Wells. New York. 1874.

Railway Association. Proceedings of the Second Quarterly Meeting of the Western and Southern—July 9, 1872. Indianapolis.

Railroad Reports as follows:  
Alleghany Valley, R. R. Co.—25th Annual Report. Pittsburgh. 1871.

Baltimore & Ohio R.R. Co.—47th Annual Report. Baltimore. 1873.

Bellefontaine & Indiana R.R., and Indianapolis, Pittsburgh & Cleveland R.R.—Annual Report. Indianapolis. 1865.

— R.R. Co.—3d Annual Report. Indianapolis. 1867.

Boston & Worcester R.R. Co.—32d and 38th Annual Reports, 1861 and '67. Boston.

Central Pacific R.R. Co.—Annual Report. 1872. Sacramento.

Chicago & Alton R.R. Co.—7th Annual Report. 1869. Chicago.

— Burlington & Quincy R.R. Co.—Annual Report. 1867. Chicago.

— & Northwestern R.R. Co.—Annual Reports. 1865-'68, 1871-'73. New York. 7 nos.

- Chicago, Rock Island & Pacific R.R. Co.—Annual Reports, 1867-'8, 1870-'73. New York. 4 nos.
- Cincinnati, Hamilton & Dayton R.R. Co.—President's Circular, Feb. 22d, 1867, and 21st Annual Report, 1868. Cincinnati. 2 nos.
- , Sandusky & Cleveland R.R. Co.—Report, July 1st, 1871. Sandusky.
- Cleveland, Columbus & Cincinnati R.R.—Annual Reports, 1861-'6, '7, '70-'72. Cleveland. 5 nos.
- , Painesville & Ashtabula R.R. Co.—Report on the Preliminary Surveys, by F. Harbach. March 29th, 1859. Annual Reports for 1865, '7, '8. 4 nos.
- & Pittsburgh R.R.—Annual Reports, 1868, '72. Lease to the Pennsylvania R.R. Co., 1871. Cleveland. 3 nos.
- Columbus & Hocking Valley R.R.—Annual Report, 1871. Columbus.
- Detroit & Milwaukee R.R.—Reports for 1868, '71, '73. 3 nos. Detroit.
- Erie Railway Co.—Annual Reports, 1863, '67. 5 nos. New York.
- & Cleveland R.R.—Acts of the Legislature of Pennsylvania, with Charter and Report of Chief Engineer. Cleveland. 1850.
- Eastern R.R.—Annual Report, 1873. Boston. 2 nos.
- Flint & Pere Marquette Ry. Co.—Annual Reports, 1868, '71. Detroit. 3 nos.
- Grand Western Ry. of Canada—Semi Annual Reports, 1867-'69. 5 nos. London.
- Hudson River R.R.—Report on the Location. J. B. Jervis. January 12th, 1848. New York.
- Indiana Central Ry. Co.—7th Annual Report. Richmond. 1859.
- Jackson, Lansing & Saginaw R.R. Co.—Reports, 1870. Jackson.
- Jamestown & Franklin R.R. Co. and Mercer Iron & Coal Co.—Charters and Acts of Legislature of Pennsylvania. Cleveland. 1864.
- Lake Shore Ry. Co.—Annual Report, 1868. Cleveland.
- Leavenworth, Lawrence & Galveston R.R. Co.—Annual Report, 1872. Chicago.
- Louisville, Cincinnati & Lexington R.R. Co.—Annual Report, 1868. Louisville.
- & Frankfort R.R. Co.—17th Annual Report, 1865. Louisville.
- Maine Central R.R. Co.—Annual Report, 1873. Augusta.
- Michigan Central R.R. Co.—Annual Reports, 1849, '52, '63, '65, '67. Boston. 6 nos.
- Annual Reports of the R.R. Corporations in the State for 1867. Lansing.
- Milwaukee & Chicago R.R. Co.—Annual Report, 1862. Milwaukee.
- & Prairie du Chem Ry. Co.—2d Annual Report, 1872. Milwaukee.
- & St. Paul Ry. Co.—8th Annual Report, 1872. Milwaukee.
- New York Central R.R. Co.—Annual Reports for 1856 and '66. Albany. 2 nos.
- & Erie R.R. Co.—Reports, November, 1853, of the Receivership from August 16th, 1859, to December 31st, 1861. New York. 2 nos.
- & New Haven R.R. Co.—Annual Report, 1872. New York.
- Northern Pacific R.R.—Report on Construction. 1867.
- Ohio & Mississippi Ry. Co.—Annual Report, 1873. St. Louis.
- Pacific R.R.—Report of Col. J. H. Simpson on the different Railroad Routes and Wagon Roads in the Territories. Washington. 1865.
- Reports of the House Committee—36th Congress. Washington. 1860.
- Pacific R.R. 19th Annual Report, 1869. St. Louis. 3 nos.
- Pennsylvania R.R. Co.—Annual Reports for 1866 & '73. Phila. 2 nos.
- Annual Reports of the Railroad, Canal and Telegraph Companies operated in the State for 1873. Report of Sub-Committee in regard to R.R. Co.'s making incorrect Returns, 1873. Harrisburgh. 2 vols.
- Philadelphia & Reading R.R. Co.—Annual Report, 1874. Philadelphia. 2 vols.
- Pittsburgh, Fort Wayne & Chicago R.R. Co.—6th Annual Report, 1867. Pittsburgh.
- Port Huron & Lake Michigan R.R. Co.—Organization, &c., 1866. Port Huron.
- Rutland R.R. Co.—Reports, 1872. Rutland.
- Shenandoah Valley R.R. Co.—Reports of H. Haupt, Chief Engineer, and J. P. Lesley, Geologist, 1870. Philadelphia.
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## ANNOUNCEMENTS.

MEETINGS.—The next *evening* meeting of the Society will be held Wednesday, September 16th, at 8 o'clock P.M., when the paper by Capt. James B. Eads, on "Upright Arched Bridges," read at the Annual Convention, and Mr. Edwin Thacher's "Practical Questions on Bridge Construction," published in August Transactions, will be discussed; other matters of interest will also be presented.

The next *stated* meeting of the Board of Direction will be held Monday, October 5th, at 2 o'clock P.M., for the transaction of regular business.

The next *afternoon* meeting of the Society will be held Wednesday, Oct. 7th, at 1 o'clock P.M., when ballots for members will be canvassed, a report of the committee on Annual Conventions, appointed September 3d, will be presented, a paper by Professor De Volson Wood, on "Hydraulic Motors," and one by Mr. John Avery on "Under Ground Drainage in New York" (both previously announced), will be read, and other business transacted.

RAPID TRANSIT AND THE HANDLING OF FREIGHT IN NEW YORK.—Attention is called to the appointment, at the last meeting of the Society (see page 123), of a committee on this

subject, to examine plans and receive suggestions from persons interested in the matter, Such may communicate with Mr. O. Chanute, Chairman of the Committee.

REPORTS OF COMMITTEES.—Members of the several standing and special committees of the Society (see 2d page of cover for list) are reminded that reports will be called for, at the Annual Meeting, November 4th next.

COMMENTS AND DISCUSSIONS.—On the papers published in "Transactions," are solicited from members, whether present at the meetings of the Society or not. They are urged to contribute selections from their note-books and other similar recorded experience, bearing upon the subjects considered; those seeking information are asked to suggest professional topics for discussion.

PHOTOGRAPHS OF MEMBERS.—By resolution of the Society, each member has been requested to furnish two photographs of himself, of the usual card size, as a means of promoting social recognition and intercourse. Those who have not complied with this request are specially asked to aid in making the collection complete, by speedily forwarding their photographs, endorsed with autograph and date.

RATES PAID

FOR LABOR OF VARIOUS KINDS

IN 1873 AND 1874.

For the purpose of comparing the prices paid for labor at different points in this country and abroad, a circular of enquiry was sent May 15th last to members of the American Society of Civil Engineers and others. From replies received up to August 22d last, the annexed schedules were prepared: most of the rates given for 1874, however, refer to the first five months of the year.

An examination of the prices reported, with reference to rates of pay for common labor shows that of the 63 cases at points in this country and Canada where laborer's wages for both 1873 and 1874 were quoted, in 41 there were reductions in prices in 1874 as compared with 1873, in 22 there was no change and in no case was the price increased. Taking into account the localities where there was a change in price, the aggregate reduction was 16.6 per cent., and including the others where there was no change, it was 10.8 per cent.

Any who are interested in the matter may refer to a table given in the "First Annual Report of the Board of Commissioners of the Department of Public Parks" (New York), pages 127, 128, showing the rates of pay per day for different kinds of labor on New York Parks, from November 1st, 1857, to April 1st, 1871.

The compilers of this paper desire here to thank the gentlemen who, by reply to the circulars sent out, contributed the necessary data.

New York, September, 1874.

JOHN BOGART,  
G. LEVERICH.

## ABSTRACT OF

## RATES PAID PER HOUR FOR COMMON LABOR IN 1874.

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Cents.	Where Paid.
27.5	Philadelphia (Navy Yard), Pa.
25.	Newport (Fort Adams), R. I. and New York City (Docks and Parks).
25.—17.5	Phoenixville (Erecting Bridges), Pa.
20.	Cambridge, Mass., Hartford, Conn., and Salt River Bridge, Ky.
17.5	Manchester (Water Works), N. H., Boston, Northampton, Russell and Holyoke, Mass., New York City (Fourth Avenue Improvement), Astoria and Waterford (Canals), N. Y., Hazleton and Wilkes-Barre, Pa. and St. Anthony Falls, Mo.
17.5—15.	Brooklyn and Elmira, N. Y., Cincinnati (Railroad), Ohio and Evansville, Ind.
16.7	Providence, R. I.
16.2	Troy, N. Y.
15.	Fall River, Mass., Middletown and New Haven (Railroad), Conn., Brooklyn (Water Works Reservoir) and Buffalo (Water Works), N. Y., Springtown, N. J., Philadelphia, Pittsburgh (Water Works Reservoir) and Orbisonia, Pa., Baltimore, Md., Cincinnati, Columbus (Railroad) and Ashtabula (Harbor Work), Ohio, Chicago, Ill., St. Louis, Mo., Nashville, Tenn. and Ottawa, Can.
15.—14.	Houston, Texas.
15.—13.	Lawrence, Mass.
15.—12.5	Cleveland (Railroad) Ohio, Erie (Railroad), Pa., Milwaukee, Wis. and Louisville (Water Works), Ky.
14.	Louisville (Bridge and Iron Work), Ky.
14.—12.5	La Cross (Railroad), Wis.
13.8	Rochester (Water Works), N. Y. and Frederickton, N. B.
13.6	Lowell (Laying Pipe), Mass.
13.5	Paterson, N. J.
13.1—11.9	Grand Trunk R. R., in Maine, New Hampshire, Vermont and Michigan.
12.5	Red Bank, N. J., Washington, D. C. and Atchison, Kan.
12.5—10.	Baltimore and Annapolis (Railroad and City Work), Md.
12.	Louisville (Railroad), Ky.
10.6—9.5	Grand Trunk R. R. in Canada.
10.	Nashville (Railroad), Tenn.
9.8—8.1	Liverton (Mines), England.
9.1	Glenwood, Va.
7.5	Montgomery, Ala.



# AMERICAN SOCIETY OF CIVIL ENGINEERS.

## PROCEEDINGS.

### MINUTES OF MEETINGS.

(Abstract of such as may be of general interest to members.)

#### OF THE SOCIETY.

SEPTEMBER 16TH, 1874.—A stated meeting was held at 8 o'clock P. M.

The paper by James B. Eads, C. E., on "Upright Arched Bridges," presented at the Sixth Annual Convention, was discussed by Messrs. Francis Collingwood, Charles Macdonald and others, and remarks thereon by Messrs. Thomas C. Clarke, Louis Nickerson, William S. Pope and Samuel H. Shreve, were read.

OCTOBER 7TH, 1874.—A regular meeting was held at 1 o'clock P. M.

The vote on admission to membership was canvassed, and the following declared elected; Members, Messrs. J. Foster Flagg, of Meadville, Pa., Washington Jones, of Philadelphia, Pa., and Horatio G. N. Reed, of Sheboygan, Wis., and Junior, Mr. George E. Clay, of New York.

The death on April 14th, of Mr. William Phillips, late of Pittsburgh, Pa., Fellow, and on September 27th, of Mr. Isaac C. Buckhout, late of New York, Member, of the Society was announced; appropriate resolutions referring to the latter, prepared at the request of a meeting of members held September 30th, were submitted and adopted.\* Messrs. William P. Shinn and Felician Slataper, were appointed a committee to present a memorial of Mr. Phillips, and Messrs. John Schuyler and William J. McAlpine, of Mr. Buckhout.

Communications from F. A. P. Barnard, L.L.D., and Gen. John G. Barnard, expressing consent to act as members of the Board of Censors to award the Norman Medal, and one from George A. Briggs, C. E., on the "Granite Mill Disaster," at Fall River, Mass., were read.

The appointment of Mr. Ashbel Welch, as member of the committee on "Rapid Transit," in place of Mr. Buckhout, deceased, was announced.

The Secretary submitted for the Board of Direction an amendment to the By-Laws, Section 23, the adoption of which was moved, and made the order for the next regular meeting of the Society.

\* Printed on page 133, following.

† Printed on next page.

## OF THE BOARD OF DIRECTION.

OCTOBER 5TH, 1874.—A stated meeting was held at 2½ o'clock P. M., and proposals for admission to the Society were considered.

The President, as Chairman of the Committee on a revised Constitution for the Society, submitted, as satisfying present requirements, an amendment to the By-Laws, Section 23, which it was ordered should be presented at the next meeting of the Society for adoption.

## AMENDMENTS TO BY-LAWS OF THE SOCIETY,

SUBMITTED OCTOBER 7TH, 1874.

SECTION 23. [To read] Requirements for the several classes of membership, shall be as follows :

1st. An Honorary Member shall be one of *acknowledged eminence\** in some branch of engineering, who has had not less than thirty years' practice.

2d. A Corresponding Member shall be one, not a resident of the United States, eminent in a special branch of engineering, or able to supply valuable information relating thereto, who will communicate with the Society at least once a year.

3d. A Member shall be a Civil, Military, Mining or Mechanical Engineer, who has been in active practice as such for seven years (or has graduated as Civil Engineer and been in practice for five years), and has had responsible charge of work as *Chief, Resident or Superintending Engineer for at least one year; not as a skillful workman merely, but as one qualified to design as well as to direct public work.*

4th. An Associate shall be a manager of a railroad, canal or other public work; a geologist, chemist or mathematician; a proprietor or manager of a mine or metallurgical works; an architect or a manufacturer; or one who, from his scientific acquirements or practical experience, has attained eminence in his special pursuit, qualifying him to coöperate with engineers in the advancement of professional knowledge; *but shall not himself be practicing as an engineer.*

5th. A Junior shall be one \* \* \* who has had actual practice in some of the branches of civil, military, mining or mechanical engineering, for not less than two years; or, if a graduate of a scientific or collegiate institution—for not less than *one year.*

The term *Junior* is to be understood as not referring to the age of the person, but to his classification in the Society for the time being. He is *Junior* to *Members* in the sense that his professional experience has had a more limited scope than theirs, whilst he is eligible to become a *Member* which an *Associate* is not.

6th. A Fellow shall be an acceptable subscriber to the funds of the Society, who has signified to his proposers a desire to be nominated, and an intention, if elected, to become a member of this class.

\* Changes from the Section now in force are in *italics* or small type.

## RESOLUTIONS OF THE SOCIETY

## ON THE DEATH OF ISAAC C. BUCKHOUT, C. E.,

ADOPTED OCTOBER 7TH, 1874.

At a meeting of members of the American Society of Civil Engineers, held September 30th, 1874, for the purpose of taking action relative to the death of Mr. Isaac C. Buckhout, Member of the Society, Mr. Edward H. Tracy was called to the chair, and on motion of Mr. G. Leverich, a committee to draft resolutions expressive of the sense of the members and to report at the next meeting of the Society, was appointed, consisting of Messrs. John Schuyler, John Bogart and Charles K. Graham.

The committee report the following :

Whereas, It has pleased the Almighty to remove from us our fellow-member, Mr. Isaac C. Buckhout, Chief Engineer of the Harlem Railroad Co., the Society desires to record its appreciation of his character, and the esteem and regard in which he was held; therefore,

Resolved, That the Society deeply laments the loss from its ranks of a distinguished member, who by his eminent services in the profession, has, while yet a young man, shown so great abilities, especially in the works in this city—the Grand Central Depot, the improvement of Fourth avenue, and others of importance, which owe their success largely to his skill and perseverance.

That the Society recognizes the great worth and value of the example of his life.

That we sympathize with his bereaved family and relatives, and that a copy of these resolutions be forwarded to them.

JOHN SCHUYLER, Chairman.

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 REPORT ON

## THE ANNUAL CONVENTIONS OF THE SOCIETY.

PRESENTED BY THE SECRETARY, SEPTEMBER 3d, 1874.

At this, the first regular meeting of the Society held since the Sixth Annual Convention, it seems proper that we should consider the purposes of these assemblages, and the results of the last, and, comparing the two, try to deduce therefrom something which shall tend to give them in the future a more distinct character.

The first Annual Convention of the Society was held in pursuance of this resolution, passed March 17th, 1869 :

"In view of extending the influence of the Society, and of bringing resident and non-resident members in close proximity :

"Resolved, That measures be taken to inaugurate a series of annual meetings or conventions."

In accordance therewith, a circular was sent to members, May 10th, 1869, as follows :

"Our Society has of late been impressed with the importance of annually gathering its members in convention, for the inter-

change of ideas and the discussion of professional subjects, as well as those relating to the extension of its own field of usefulness."

"These objects cannot be attained by means of the twenty-three regular meetings held during the year, on account of the distant residence of many of its members; but they require the appointment of some day on which all can meet and strengthen that bond of sympathy which should animate hearts engaged in the furtherance of a common cause."

"It is proposed, therefore, to hold the first of such a series of conventions on the 16th day of June, 1869, commencing at 10 A. M. The Society relies on the individual efforts of its members for sustaining the interest of the occasion, and desires that you will either come prepared to read a brief professional paper (in case of unavoidable absence will forward such to the Secretary) or else be prepared to make some statement of engineering experience calculated to prove of general interest."

It will be noticed that conventions were then called solely for social and professional improvement, and, excepting at the ones held in Chicago and Louisville, no purely business matters have been introduced. This is consistent with Art. II of the Constitution, which states the objects of the Society to be "the professional improvement of its members" and "the encouragement of social intercourse among men of practical science."

The policy of the Society and the management of its affairs has been necessarily elastic, changing to meet new demands with the increase in members and additions to its resources. The first idea of professional improvement was, that members would introduce a topic at a meeting, either formally, as in a paper, or informally by verbal statement, and that others present would, from their varied experience make due comment. This idea largely included the social feature, but as members were admitted who were prevented, if resident, by their engagements, or, if non-resident, by their location, from frequently attending the meetings and taking part in these discussions, the presentation and treatment of topics necessarily became formal; written papers took the place of oral statement, and the social element largely disappeared.

Again, it is now generally conceded that without previous knowledge of the contents of a paper, to hear it read before the Society is almost profitless—the nature of their profession and experience is such, that Engineers can rarely speak from fullness of knowl-

edge; time for consideration and reference to notes is required; whence in this respect the purpose of association is best served by a publication of papers in the Transactions, and of their discussion in due course afterwards, as offered.

When the Society was small and local, the members were known to each other; now that it is larger and more than national (it includes among its members, residents of Canada, of several of the South American States, of India, Japan and almost every country in Europe—as well as of the United States), only the Treasurer and Secretary know their names, and probably neither has met more than one-half their number, face to face.

It may be said that acquaintance among members, particularly among non-residents, would be largely promoted by the regular publication of a list of members, their addresses and engagements, and the issue to members of a certificate or card of membership; then such, otherwise unknown to each other, could become acquainted without introduction. Sometimes, also, a certification of membership of this Society is an introduction of itself, to kindred bodies and their members, as well as an admission to public and private engineering works not otherwise accessible; this is particularly true abroad.

The objects of Conventions of the Society should be kept in view:—

1st.—The social advantage of such a meeting of professional men, who largely work alone and often in antagonism. At the Convention, facilities for making acquaintances and exchanging views should be afforded to the fullest extent—hence the usefulness of semi-professional excursions, where members may meet without hurry or reserve.

2d.—To draw out and preserve such statements of experience, as leading Engineers may orally give in debate, but will not, from lack of time, or a modest inappreciation of the worth of such, present in a more formal way.

To do this it is suggested:—

1.—For the Convention proper, that all papers and reports, except the simplest and most brief, be printed and distributed to members in time for careful reading and examination, and that the Convention shall only discuss the same and take requisite action thereon.

To this end, it may be well to early announce that certain prominent subjects, treated in the published papers of the Society—as "Economy of Railway Traffic," "Tests of Materials," "The Relation of Rainfall to Water Supply," &c., will be called up at the

Convention, and debate secured by asking certain members familiar with these topics to lead off; or the several papers of the preceding year may be called up in regular order for discussion.

II.—For the remainder of the session, that less time be given to the formal and more to the informal meetings—as semi-professional excursions and the annual dinner, and that the whole be deftly sandwiched together, thereby avoiding the hurry, cramming and general discomfort consequent upon an attempt to do too much.

Much thought and time must be given to arranging and conducting a Convention, so as to secure an Engineer's result—"the best effect with the least effort or expenditure"—and since these assemblages are now a regular

part of Society work, it would seem that a standing committee should be charged largely with the management; say the President, Secretary, Chairman of the Finance and Library Committees, and three Members who reside where the Convention may be held and shall be elected at the Annual Meeting—making altogether a committee of seven members, a majority of whom would, by virtue of other official standing, usually serve longer than one year.\*

\* "The Secretary made report on the Sixth Annual Convention, which was accepted, and on motion, referred to a committee consisting of Messrs. G. Leverich, A. P. Boller and M. N. Forney, to report at the next regular meeting of the Society." (Extract from the minutes of the regular meeting of the Society, held September 2d, 1874.)

## NOTES AND MEMORANDA.

Members are desired to contribute selections from their note books and similar records of experience referring to engineering practice, and those seeking information are asked to suggest professional topics for discussion.

**THE GRANITE MILL DISASTER AT FALL RIVER, MASS.**—This deplorable event which occurred on the morning of Saturday, September 19th, was the cause of the death of twenty-one operatives, and of more or less injury to thirty-two others.

The fire originated in mule-head No. 15, the second mule from the north end of the mill on the fourth floor, and was caused by the friction of a small pulley which had been allowed to run too long without oiling the bearing. The pulley was held in its position by a band; the bearing being open at the bottom only a small quantity of oil could be applied at a time—no oil-cup was attached for supplying the journal. It is not an uncommon event for a mule-head to catch fire, although it does not often occur.

The provisions made for extinguishing fires in this mill were as good as they usually are in cotton mills, and would answer well for all ordinary purposes if applied in time. On the outside of the mill four 3-inch water-pipes are carried up by the side of the fire escapes to the fifth story, and one goes up inside of the tower to the top. Each of these pipes has a 2-inch hose connection at each story. Another 3-inch pipe is carried up inside of the mill, on the east side to the tanks in the sixth story; this pipe and the tanks are supplied by an 8-inch pump attached to the main engine, which drives all of the machinery in the mill. In each story, and nearly in the

middle, a 1½-inch water-pipe is attached to the underside of the floor-beams, and extends to within a short distance of each end of the mill; three hose were attached to these pipes in each story, convenient of access and ready for use at all times. The water for these pipes is supplied from the tanks in the sixth story. There are two of these tanks, 30 feet long and of 30 inches diameter. The water-pipes outside of the mill, and the one in the tower are supplied by a 12-inch Knowles & Libby pump, which is placed in a separate building on the east side of the mill.

In reviewing the situation, and all the circumstances surrounding the disaster, it is evident that the greater portion of the operatives became panic-stricken upon the first intimation they had of the mill being on fire; these working upon the fifth and sixth floors rushed to each end of the mill and leaped from the windows to save their lives and were killed by the fall, while others who could not get out, or did not have the courage to make the leap, were burnt or smothered to death in the building.

More ample provisions should have been made for extinguishing fires, and for the escape of the operatives. Water-pipes for supplying a mill of this character and size\*

\* The mill was 328 feet long, 50 feet wide, 65 feet high to the sixth story windows and 75 feet to the ridge of the roof; it contained 36,648 spindles.

should be from 4 to 6 inches in diameter and two lines of pipe 2 to 2½ inches diameter, should be carried through the mill lengthwise in each story instead of one 1½ inch line, as in this mill. The leading mains should be carried up on the inside of the mill, and kept full of water, so as to be ready for use at any moment; suitable provisions should also be made for "Fire Hydrants" in the mill yard.

The fire escapes should be ample in all cases, and placed at each end of the mill as well as at the sides, with platforms at each story large enough for forty operatives to stand upon (if the mill is as large as the one under consideration), and surrounded

by a strong railing, to prevent any one from being crowded off.

Fire companies should be formed among the mill hands, and they should practice once in two weeks, so as to keep perfectly familiar with the use of all parts of the apparatus for extinguishing fires.

All of the additional provisions for the protection of the mills and the lives of the operatives herein suggested is a mere trifle with reference to the cost of a mill, and not worth considering for a moment when compared with the security to be gained.

G. A. BRIGGS.

Fall River, Oct. 5, 1874.

#### NEW BOOKS ON

### ENGINEERING AND TECHNOLOGY.

Under this head will be announced new books on these and kindred subjects published in English, French and German, which may be professionally useful to members of the Society.

At the present rates of duty and exchange, the cost of imported books may be estimated in federal money, at one shilling equal to 50 cents.

Architectural Sketch Book, containing Plans of Churches, Railway Stations, Stores, Cottages, School-houses, Court-houses, Fountains, etc. Edited by the Portfolio Club, and comprising Designs by the most eminent Architects of New England. Boston. 4to. \$6.50.

Architecture. Arrangement of Houses, considered in Reference to sanitary and artistic Requirements. Henry Maccormack, M.D. Belfast. 8vo. \$0.25.

—, Homes and how to make Them. E. C. Gardner. Boston. 12mo. illus. \$2.00.

—, Specimens of the Architecture of Normandy. New ed. A. Pugin and J. T. H. Lekeux. Edited by R. P. Spiers. Edinburgh. 4to. 42s.

Army Advance eastward. Based on the official reports of Lieut. Hugo Stumm; to which is appended other Information on the Subject, and a minute Account of the Russian Army. E. E. Howard Vincent. 8vo, pp. viii—187. Henry S. King & Co. London. 8vo.

Botany. The Forest Flora of north-west and central India, published under the Authority of the Secretary of State for India in Council. J. L. Stewart and D. Brandis. London. 8vo. 18s.

—, Plants, their Natural Growth and Ornamental Treatment. F. E. Hume. London. Folio.

Builder; Village—with supplement. New ed. A. J. Bicknell. New York. 4to, illus. \$12.00.

Chemistry. Chemical History of a Candle. Michael Faraday. New ed., edited by Wm. Crookes. London. 12mo, illus. \$2.00.

—, Lecture Notes on Qualitative Analysis.

Henry B. Hill, Ass't Prof. of Chemistry. Harvard Univ. New York. 16mo. \$0.75.

Clocks. A rudimentary Treatise on Clocks, Watches and Bells. 6th ed., revised and enlarged. Sir E. B. Denison. London. 12mo. 4s. 6d.

Coal. The Coal and Iron of southern Ohio. 2 maps. T. S. Hunt. Salem. 8vo.

Drawing. An elementary Treatise on orthographic Projection; being a new Method of Teaching the Science of mechanical and engineering Drawing. 7th ed. William Burns. London. 8vo. illus. 9s.

Engineering. Occasional Papers on Subjects connected with Civil Engineering, Gunnery and Naval Architecture. Michael Scott. London. 2 vols. 8vo. 42s.

Engineers. Society of—, Transactions for 1872. London. 8vo. \$4.25.

Forces. The various Forces of Nature and their Relations to each other. Michael Faraday. Edited by William Crookes. London. 12mo. illus. \$2.00.

Gas Manager's Hand-book, consisting of Tables, Rules, and useful Information for Gas Engineers and others engaged in the Manufacture and Distribution of Coal Gas. Thomas Newbwing. 2d ed. London. 12mo. \$3.75.

Geometry, Descriptive—adapted to Colleges and Purposes of liberal Education, as well as to technical Schools and technical Education. Part I. Surfaces of Revolution. The Point, Line and Plane, developable Surfaces, Cylinders and Cones, and the conic Sections, warped Surfaces, the hyperboloid double-curved Surfaces, the Sphere, Ellipsoid, Torus, etc. Prof. S. Edward Warren. New York. 8vo. illus. \$4.00.

Landscape Gardening. The natural Principles of—, J. F. Johnson. Belfast. 8vo. 7s. 6d.

Mechanics, Elements of analytical—, W. H. Bartlett. New York. 8vo. \$5.00

—, First Lessons in theoretical—, Rev. J. F. Twisden. London. 8vo. 8s. 6d.

Patents, Law of Design—containing all reported Decisions of the U. S. Courts and the Patent Office, in Design Cases, to 1874, with Digests and Treatise. Wm. E. Simonds. New York. 8vo. \$4.50.

—, Report of the Commissioners of Patents for Inventions. With Plan. (Parliamentary Report.) London. 6d.

—, Specifications and Drawings of Patents issued from the U. S. Patent Office for March, 1874. Washington. 8vo.

—, The Law and Practice relating to Letters Patent for Inventions; together with Notices of the Patent Laws in force in the principal foreign States and in the Colonies. With Appendix, containing the Statutes, Rules, &c. W. Fischer Agnew. London. 8vo. 21s.

Railway. Gazetteer of Railway Stations in the United States and the Dominion of Canada. Compiled by W. F. Allen. Philadelphia. 16mo. \$1.00.

—, Treatise on Railway Signals and Accidents. Arch. D. Dawney. London. 8vo. \$1.00.

—, Detailed Return of Accidents which

occurred in 1873. (Parliamentary Report.) London. 2s.

Scientific Instruction. Fifth Report of Royal Commission (University and King's Colleges, London; Owen's College, Manchester; College of Physical Science, Newcastle-on-Tyne; Catholic University of Ireland). London. 8vo. 6d.

Ship. History of, from her Cradle to her Grave; with a short account of Steam Ships, and of their Introduction into the mercantile Marine and the Royal Navy. New ed. London. 16mo. illus.

Telegraph and Travel. A Narrative of the Formation and Development of telegraphic Communication between England and India, by Col. Sir Fred. John Goldsmid. London. 8vo. illus. \$8.00.

Training, in Theory and Practice. Archibald MacLaren. 2d ed. London. 12mo. illus. \$2.25.

Transit of Venus. George Forbes, M. A., Prof. of Nat. Philos. Glasgow. 12mo. illus. \$1.25.

Waters. The Circulation of—on the Surface of the Earth. H. W. Dove. Boston. 12mo. \$0.25.

Wood and its Uses, a Hand-book for the Use of Contractors, Builders, Architects, Engineers, Lumber Merchants, etc., with Information for Drawing up Designs and Estimates. P. B. Eassie. Gloucester. 8vo. illus. \$0.75.

## LIBRARY AND MUSEUM.

### ADDITIONS IN SEPTEMBER, 1874.

NOTE.—Members and others are asked to contribute regularly to the library of the Society, copies of government, municipal, railway, canal and other reports, specifications, profiles, maps, photographs and like matter, making up the record of engineering operations for the past or present, and to inform the Secretary where such may be had. Duplicate copies are desired, for transmission to foreign societies in return for works collected and sent to this library by them; also for exchange with members and others who wish complete sets referring to particular subjects. In order to gather material now considered of but little value, but of great future importance in the history of the public works of this country and a comparison of their economical results, donations are solicited of old reports or pamphlets, which in any way refer to their construction or operation.

### DONATIONS ARE ACKNOWLEDGED AS FOLLOWS:

From S. T. Abbott, Washington, D. C.:  
Specifications for Improvement of Aquia and Nominie Creeks—Ocequan and Rappahannock Rivers. 4nos.

From J. W. Adams, Brooklyn, N. Y.:  
Report of the Brooklyn Commissioners of City Works for 1873.

From Chamber of Commerce, N. Y.:  
Statements of the agricultural Products of the U. S., from 1840 to 1870. S. B. Ruggles.

From O. Chanute, New York:  
American Exchange and Review. 1872.

—, Polytechnic Journal. 1853.

Bridge—Report of the Board of Civil Engineers, convened August, 1867, on Con-

struction of a Bridge across the Mississippi River at St. Louis. 1867. 2 copies.

Canals. Annual Reports of the State Engineer on the New York Canals for 1850, '51 and '53. 3 vols.

—, Report of State Commissioners on New York Canals for 1853.

Chicago—Its Railroads. History and Commerce. 1854.

Coal. La Salle Coal Mining Co.—By-Laws and Report. 1856.

—, Little Rock Mining Company, Operations of—, 1858. 2 copies.

—, Marion County, Va., Cannel Coal Field, Report. 1858.

—, Grate and Damper for Locomotives, &c. Henry Yates.



- Comptroller of New York State, Report of—, 1843.
- Contract and Specifications for the North Missouri R.R., 1866.
- Driving Wheel; Griggs' Improved—, 1865.
- Fuel. To the Citizens of Chicago on the Fuel Question. 1867. 2 copies.
- Guide Book to Railroads in Great Britain. Bradshaw's.
- Horse Railway Monopoly; Report, Proceedings and Speeches of a Public Meeting of Citizens. Chicago. 1865.
- Illinois & St. Louis Bridge Co. Report of the Chief Engineer. 1868. 3 copies.
- Geological Survey; Abstract of Report on Illinois Coal and Coal Fields. 1856.
- Land Co. Report of John Tillion, Gen. Agt. 1840.
- Industrial Resources, &c., of the Southern and Western States. J. D. B. De Bow. 3 vols.
- Iron and Steel Association. Letter from Daniel J. Morrell. 1865. 3 copies.
- Mountain of Lake Superior, By-Laws, &c., of the Chicago and Lake Superior Iron Mining & Manufacturing Co. 1855.
- Kansas, Resources of—, Topeka. 1871.
- State of—Public Documents for 1871. Topeka.
- Board of Agriculture, Transactions of—, 1872. Topeka.
- City; Manufacturing Resources of—, An Address by W. D. Kelly. 1873. 2 copies.
- Long-Span Railway Bridges. London. 1867.
- Memorial Citizens of Chicago, relative to a national Armory and Foundry. 1861.
- Navy Yard; Report of the City Engineer relative to a U. S. Navy Yard at St. Louis. 1862.
- Ohio; Report of the Commissioners of Statistics. Columbus. 1866.
- Pneumatic Bridge Foundations. O. Chamute. Peoria; Report on Water Supply of—, 1864.
- President Petroleum Co.; Prospectus of—, 1865.
- Railroad and Canal Companies of Pennsylvania; Auditor General's Report on—, 1865.
- Corporations in Massachusetts; Returns of—, for 1865. Boston.
- Railroads of New York; Report of the State Engineer for 1851.
- Railroad Reports as follows:
- Baltimore & Ohio R.R. for 1855-'62, '71-'73. Baltimore. 11 nos.
- Bear Mountain R.R. for 1845.
- Bellefontaine R.R. for 1861.
- Boston & Providence R.R. for 1864.
- & Worcester R.R. for 1859.
- Charlotte & North Carolina R.R. for 1859.
- Chicago & Alton R.R.—Official Guide to—, for 1872.
- , Burlington & Quincy R.R. for 1871 and '73. 2 nos.
- & Northwestern R.R. for 1862.
- Cincinnati, Hamilton & Dayton R.R. for 1858, '60, '63 and '64. 5 nos.
- , Wilmington & Zanesville R.R. for 1858.
- Denver & Rio Grande R.R. for 1873.
- Galena & Chicago Union R.R. for 1859.
- Great Western Railway of Canada for 1857 and '66. 2 nos.
- Housatonic R.R. for 1860.
- Joliet & Northern Indiana R.R. for 1854.
- La Crosse & Milwaukee R.R. for 1856. 2 nos.
- Long Island R.R. for 1859. 2 nos.
- Macon & Brunswick R.R. for 1857.
- Milwaukee & Mississippi R.R. for 1859.
- Mine Hill & Schuylkill Haven R.R. for 1859.
- Mobile & Ohio R.R. for 1849 and '59. 2 nos.
- New Albany & Salem R.R. for 1860.
- New Haven, New London & Stonington R. R. for 1860.
- Orleans, Opelousas & Great Western R.R. for 1859, '60 and '65. 3 nos.
- York & Albany R.R. for 1841.
- & New Haven R.R. for 1871.
- Central R.R. Letter from G. W. Cass.
- North Missouri R.R. for 1854.
- Northern Central R.R. for 1862.
- Illinois R.R. for 1862.
- Northwestern Virginia R.R. for 1857.
- Ohio & Mississippi R.R. for 1858, '59 and '61. 3 nos.
- Ogdensburgh & Lake Champlain R.R. for 1842.
- Ontario, Simco & Huron R.R. for 1854.
- Peoria & Hannibal R.R. for 1858.
- Pennsylvania R.R. for 1863, '65 and '66. 3 nos.
- Philadelphia, Wilmington & Baltimore R.R. for 1858, '61 and '62. 3 nos.
- Pittsburgh R.R. & Coal Co. for 1864. 2 nos.
- , Washington & Baltimore R.R. for 1871.
- Port Sull van, Belton & Northwestern R.R. for 1869.
- Richmond & Petersburg R.R. for 1855 and '59. 2 nos.
- St. Louis, Alton & Terre Haute R.R. for 1862-'65. 4 nos.
- & Iron Mountain R.R. for 1863 and '64. 2 nos.
- Terre Haute & Indianapolis R.R. for 1872.
- & Richmond R.R. for 1855.
- Toledo & Wabash R.R. for 1861.
- Vicksburg, Shreveport & Texas R.R. for 1858.
- Virginia Central R.R. for 1853.
- Western R.R. for 1859.
- Also:
- Railroad Iron. Manufacture of—, Daniel J. Morrell. 2 copies.
- Railways and the Wheels which run on Them. Thomas Prosser. 1865.
- Railway Association. Proceedings of the American—, 1872 and '73. 2 nos.
- Regenerative Gas Furnace. London. 1864.
- Statement, &c., of Calcasieu Sulphur & Mining Co. of Louisiana. 1871.
- Stock Yards of Chicago. 1865.
- Trade and Commerce of Chicago. 1860, '64 and '5.
- War of the Gauges; Railroad at Erie. Cleveland. 1854.
- Weather—Development of a System by which it may be Forecasted. Thomas B. Butler. Norwalk. 1870.
- From F. Collingwood, Brooklyn, N. Y.: East River Bridge Specifications for Granite Face Stones, Saddles and Saddle Plates. 5 sheets.
- From R. D. Dodge, Brooklyn, N. Y.: Argument in behalf of Sastro Tunnel. Washington. 1872.
- Catalogue of Stars observed at the U. S. Naval Observatory. 1845 to 1871. Washington.
- District of Columbia; Contract and Specifications for Water-Pipes, Stop-Cocks and Special Castings. 1872. 2 copies.
- Geological Report of the Yellowstone and Missouri Rivers. 1859 and '60. F. V. Hayden. 1869.
- Illinois & St. Louis Bridge Co. Report of the Chief Engineer. 1871.
- Machinery and Processes of the industrial Arts and Apparatus of the exact Sciences. F. A. P. Barnard. Washington. 1869.
- Memoir on the Light-house Illumination of

- the Coast of France. Washington. 1871. 2 vols.
- Mineral Resources of the United States. A. S. Sutor. Baltimore. 1868.
- November Meteors of 1867 and '8. 2 vols.
- Practical Treatise on Locomotive Engines. Count Pamboeur.
- Reports of the Smithsonian Institution for 1858, '65, '69 and '71. 4 vols.
- Report on Construction of Piers of the Aqueduct of the Alexandria Canal. W. Turnbull. Washington. 1873.
- of the Commissioner of the General Land Office. 1866.
- on the Determination of the astronomical Co-ordinates of the primary Stations at Cheyenne and Colorado Springs. Washington. 1874.
- on the Difference of Longitude between Washington and St. Louis. Washington. 1872.
- of Col. James H. Simpson on the Pacific Railroads and Branches. Washington. 1866.
- of the Secretary of Navy for 1865-'71.
- of Trial Trip of U. S. Steamer Wampanoag. 1868.
- Smithsonian Contributions to Knowledge; the Law of Deposit of the Flood Tide. Washington. 1852.
- Specifications of horizontal Back-action Engines, Boilers, Propeller and Appendages. Steam on the Canals; Report of the N. Y. State Commission. 1872.
- Washington Aqueduct; Specifications for central gate House, Parapets of Cabin John Creek, and for Water Pipe. 3 nos.
- From R. H. Elliott, Kirkwood, Mo.: Mouth of the Mississippi; the Jetty System Explained. St. Louis. 1874. Copies for distribution.
- From S. T. Fuller, Philadelphia, Pa.: Tie-Spotter and Borer. Photograph.

From F. de Funiak, Louisville, Ky.: Condensed Profiles of Louisville & Nashville, and Gt. Southern & South & North Ala. Railroads. 2 sheets.

From J. M. Goodwin, Cleveland, O.: Report of the Ohio Commissioner of Railroads and Telegraphs. Columbus. 1873.

Reports of the Illinois Railroad and Warehouse Commission for 1871 and '72. 2 vols.

Statement of the Trade and Commerce of St. Louis for 1872.

New Mexico; its Resources, Geography, Climate, Population, &c. Santa Fe. 1873. 2 copies.

Utah Mining Company—Articles of Incorporation and By-Laws. Buffalo. 1874.

From James H. Harlow, Boston, Mass.: Annual Reports of the State Board of Health, of Massachusetts, 1872 and '73. 2 vols.

From Edward Reed, Boston, Mass.: Experiments with Great Guns at Nut Island, November. 1873. Norman Wiard. Washington. 1874.

From the Society of Engineers and Associates, New York: Constitution and By-Laws. 1874.

From Robert H. Thurston, Hoboken, N. J.: On the Properties of Materials of Machine Construction. Philadelphia. 1874. 2 copies.

From Ashbel Welch, Lambertville, N. J.: Report on Safety Signals for Railroads. Lambertville. Several copies.

#### PURCHASED.

Specifications and Drawings of Patents, issued from the U. S. Patent Office for March, 1874. Washington.

### ANNOUNCEMENTS.

**MEETINGS.**—A special meeting of the Board of Direction will be held Monday, October 19th, at 2 o'clock P.M., for the consideration of the Annual Report of the Society, and other business incident to the close of the Society year.

The next evening meeting of the Society will be held Wednesday, October 21st, at 8 o'clock P.M., when a paper by Prof. Robert H. Thurston, on the "Caloric Value of wet Fuel, as determined by Experiments on a large Scale," will be read; the one by Mr. Thomas C. Clarke, on the "Education of Civil Engineers," presented at the late Annual Convention, will be discussed, and other matters of interest taken up.

The next stated meeting of the Board of Direction will be held Monday, November 2d, at 2 o'clock P. M., for the transaction of regular business.

The Twenty-Second Annual Meeting of the Society will be held Wednesday, November 4th, at 10 o'clock A.M., when the Annual Report of the Board of Direction on the affairs of the Society will be presented, and officers elected for the ensuing year.

Reports are expected from the Committee on "Tests of American Iron and Steel," W. Sooy Smith, Chairman; on the "Form, Weight, Manufacture and Life of Rails," Ashbel Welch, Chairman; on the "Means of Averting Bridge Accidents," James B. Eads, Chairman; on a "Plan for the Increase, Maintenance and Preservation of an Engineering Library and Museum," Horatio Allen, Chairman; on a "Comparative Examination of the principal Pumping Engines in Use," Gorham P. Low, Jr., Chairman; on a "Testing Laboratory," O. Chanute, Chairman; on a "Change of the Society's Rooms," John Bogart, Chairman; on "Securing a national

Recognition of the Society," Julius W. Adams, Chairman; on "Time and Place of the Seventh Annual Convention," Alfred P. Boller, Chairman, and on "Railway Signals," J. Dutton Steele, Chairman.

The Norman medal is to be awarded, and the time and place of the next (Seventh) Annual Convention determined; if the business of the Annual Meeting requires it, a second session may be held on Thursday, November 5th. An informal dinner for those who wish to join in the same, is proposed for Wednesday evening.

At the *evening* meeting of the Society, to be held November 18th, a paper by H. Wadsworth Clarke, C. E., on the "Accident occasioned by an improperly constructed Truss, in Syracuse, N. Y., June 23d, 1874," will be read, and one by Caleb G. Forshay, C. E., on the "Levees of the Mississippi," will be discussed. To facilitate consideration of the latter, which will appear in December Transactions—advance copies will be sent on request to members who wish to take part in the discussion.

**CIRCULARS.**—Since the last number of Transactions was published, the following circulars have been issued (copies of which may be had from the Secretary):

**ON THE SOCIETY, ITS RESOURCES AND OBJECTS.**—Permit me herewith to call your attention to this association, and to ask your co-operation in securing the objects it has in view.

The American Society of Civil Engineers was organized November 5th, 1832: its objects are—the advancement of science and practice in Engineering, the acquisition and dissemination of experimental knowledge, the comparison of professional experience, and the encouragement of social intercourse among its members.

Its membership numbers nearly 450 and consists of five classes: Honorary Members, those of great knowledge and experience in some branch of engineering: Members, who, as civil, military, mining or mechanical engineers, have been in active and responsible practice for a term of years: Juniors, who have thus practiced for a briefer term; Associates, who, from scientific acquirements or practical experience, have attained eminence in a special pursuit, qualifying them to co-operate with engineers in the advancement of professional knowledge; and Fellows, who are acceptable subscribers to the funds of the Society. Of these several classes those are termed residents who are within 50 miles of

New York, and non-residents who are outside this circuit. The latter includes members in nearly each of the United States, in Canada, South America, Europe, India and Japan.

Its resources are: initiation fees and annual dues from Members, Juniors, and Associates, as per statement in "Form of Application" enclosed, and payments of \$250 each to constitute a Fellow which are exclusively set apart to form a publication fund. By the Treasurer's last report, for the Society year ending November 4th, 1873, the assets of the association were:

Cash and stocks.....	\$1,786.24
Dues from members.....	8,505.00
Fellowship fund.....	8,500.00
Norman medal.....	1,250.00
Library and furniture, nominal...	5,350.00
	<hr/>
	\$25,391.24

For social intercourse and professional improvement, regular and stated meetings are held on the first and third Wednesdays of each month, except July and August; also an Annual Convention with excursions to prominent engineering works either complete or in progress.

Its rooms are at 63 William Street, New York, where the offices and Library of the Society are; these are open during business hours, and may be used by members as a place of meeting, where appointments may be kept and letters and packages delivered.

Especial attention has been given to the collection of government, municipal and other reports of public works, and similar records of engineering progress; and endeavors are being made to include in the Library and Museum all that relates to the history, theory, construction and management of public improvements, and the methods and cost of manufacturing operations, with illustrations by models and samples of the results obtained.

Papers and reports presented to the Society, on engineering subjects, with discussions thereon, and other proceedings appear in THE TRANSACTIONS, a monthly publication sent only to members, a few kindred associations here and abroad, and in exchange for leading technological journals, which are kept on file.

You are asked to aid in promoting the objects of this Society—

1st. By regularly contributing copies of reports, specifications, profiles, maps, photographs and like matter, which make up the records of engineering operations for the past or present, and informing the Secretary where such may be had.

2d. By presenting the Society and its purposes to those known to you, who would be desirable members in one of the several classes.

3d. By reporting the name, position and address of Engineers employed by you or the organization with which you are connected.

You are cordially invited to visit the rooms of the Society, and to make enquiry in regard to professional matters.

ON RAILWAY SIGNALS.—At the last Annual Convention, on motion of Mr. J. Dutton Steele, it was—

“Resolved, that a committee of three be appointed to inquire into the various systems of signals in use on the several railways of the United States, and to report upon the same to the next Annual Convention, with such recommendations as may seem important.”

Messrs. J. Dutton Steele, of Pottstown, Pa., O. Chanute, of New York, and Charles H. Fisher, of Albany, N. Y., were appointed such Committee.

The matter of signals has, for quite a number of years past, occupied the attention of railway engineers and managers. In 1866 a very interesting report on this subject was made by Mr. Ashbel Welch, to a railroad convention at the St. Nicholas Hotel, New York. In 1871 a code of signals, rules and regulations for operating railroads, was jointly agreed to by a committee of railroad officers and the Board of Railroad Commissioners of Massachusetts, which was subsequently adopted in 1872 by the Western and Southern Railway Association, now the Railway Association of America.

Notwithstanding these efforts, there is yet such diversity of practice upon the railways of the United States and Canada, as to produce considerable confusion and to lead sometimes to deplorable accidents. The employes of the various railway lines come into such close relations at junctions and crossings, and so frequently change their service from one line to another, that it seems important the utmost uniformity possible should prevail in all matters pertaining to the signals and movements of trains.

The Committee, therefore, proposes to collect all necessary information on the various systems of signals now in use upon the railways of this country, and to co-operate, so far as it can, in promoting uniformity of practice in this respect. Will you be kind enough to send us a copy of your rules and regulations concerning signals, whether embodied in your time-table or book of instructions, together with a detailed statement of such

signals as you may wish to call particular attention to, under any of the following heads?

General, or train signals with	{	the steam whistle.
		the engine bell.
		the train rope.
		the hand lamp.
		the arm and hand.
		flags.
Signal systems by	{	torpedoes.
		fuses or fire tubes.
		towers.
		semaphores or vanes.
		automatic telegraph.
		junctions of railways.
Special, or fixed signals at	{	grade crossings.
		switches.
		stations.
		tunnels.
		draw-bridges.
		inclined planes.
		switch backs.

You will much oblige us if you will send an explanatory sketch of such of these as may require it, drawn in black lines on a scale suitable for publication in the Transactions of the Society.

The Committee will feel especially obliged in receiving a description of any system of block signals, either mechanical or telegraphic, which may be in use, or favored by you, together with an account of its workings and of the advantages expected, as well as of any interlocking gear and signals to regulate the entrance and departure of trains at any large station.

It is also desired to know what system of signals would be most applicable to a triple or quadruple track railway, in which certain tracks would be used exclusively in one direction.

Replies are to be addressed to the Chairman, Mr. J. Dutton Steele, Pottstown, Pa.

ON RAPID TRANSIT AND THE HANDLING OF FREIGHT IN NEW YORK.—At the regular meeting held Sept. 3d, 1874, it was:—

“Resolved, that a Committee of five members of this Society be appointed by the President, to investigate the necessary conditions of success, and to report plans for—”

“First: The best means of rapid transit for passengers, and”

“Second: The best and cheapest methods of delivering, storing and distributing goods and freight—in and about the city of New York, with instructions to examine plans, and to receive suggestions such as parties interested in the matter may choose to offer, and to report on or before the first day of December, 1874.”

Messrs. O. Chanute, M. N. Forney, Isaac C. Buckhout,\*Charles K. Graham and Francis Collingwood were appointed such Committee.

You will confer a favor upon the Committee and the Society by furnishing whatever contribution or suggestions you may deem of value on the above subjects, or by calling attention to the sources of such information. Due credit will be given for all aid rendered to the Committee.

In referring to plans proposed to accomplish these objects, it is particularly desired to ascertain accurately—

1st. The route and location proposed, and the reasons therefor.

2d. The character of structure proposed in various parts of the city.

3d. A close estimate of the cost in detail.

It is greatly preferred that all communications shall be in writing.

Please address the Secretary.

ON TIME AND PLACE OF THE SEVENTH ANNUAL CONVENTION.—Asking members, by reply to the Secretary, to state their preference, and also to say if they will attend the Annual Meeting on November 4th, or join in an informal dinner on that day.

PUMPING-ENGINES.—The Committee ap-

\* Mr. Ashbel Welch has been appointed to fill the vacancy caused by Mr. Buckhout's death.

pointed April 1st, to collect and tabulate statistics of the principal pumping-engines in use, has, in reply to the circular issued comprising the chief subjects of Engineering, received much valuable information, the worth of which, however, will be greatly enhanced if reports can be had of a few more engines of distinct type. Members and others in charge of such, are urgently solicited to forward the records without delay to Graham P. Low, Jr., C. E., 9 Pemberton Square, Boston, or to the Secretary, from whom blanks to be filled up may be obtained.

A description, more or less complete, of the engine and its performance on special work and at regular work: why the particular style was adopted, and how far it has met expectations; with sketches, tracings or photographs and details not specified, pertinent to the object of enquiry—are asked for. Persons furnishing information will receive a copy of the report of the Committee, which it is expected will be presented at the Annual Meeting.

BINDING "PAPERS" AND "PROCEEDINGS."  
—It is intended that these two parts of the "Transactions" as issued, shall be bound separately:—with this view, the paging of the two is distinct, and in due course when a sufficient number of pages of either is printed, an index for that part will be furnished, the volume closed and another begun.

## ADMISSIONS TO THE SOCIETY.

Sept.	25th,	1874....	ANDERSON, ADNA.....	Washington, D. C.
"	10th,	"	....BURR, WILLIAM H. (J.).....	Milburn, N. J.
"	12th,	"	....CORTELL, ELMIR L.....	Louisiana, Mo.
July	28th,	"	....DAVIS, JOSEPH B. (J.).....	Ann Arbor, Mich.
"	10th,	"	....DU BOIS, EDWARD C.....	Lima, Peru.
Aug.	11th,	"	....EDWARDS, NATHANIEL M....	Appleton, Wis.
Oct.	1st,	"	....FRANKLIN, WILLIAM B.....	Hartford, Conn.
Aug.	1st,	"	....HAMILTON, SCHUYLER.....	New York.
Sept.	15th,	"	....NADER, JOHN.....	Madison, Wis.
"	9th,	"	....READ, ROBERT L.....	Indianapolis, Ind.
Aug.	11th,	"	....SCHOTT, C. RIDGELY.....	New York.
Sept.	9th,	"	....SMEDLEY, SAMUEL L.....	Philadelphia, Pa.
"	25th,	"	....STAUFFER, DAVID MCN.....	" "
"	9th,	"	....VANDERPOOL, EUGENE.....	Newark, N. J.
"	18th,	"	....WARREN, G. K., U. S. A.....	Newport, R. I.
Oct.	2d,	"	....WOOD, JOSEPH.....	Washington, D. C.

# AMERICAN SOCIETY OF CIVIL ENGINEERS.

## PROCEEDINGS.

### MINUTES OF MEETINGS.

(Abstract of such as may be of general interest to members.)

#### OF THE SOCIETY.

OCTOBER 21ST, 1874.—A stated meeting was held at 8 o'clock P. M.

Prof. Robert H. Thurston read a paper on the "Efficiency of Furnaces burning wet Fuel," which was followed by discussion.

Attention was called to two pieces of one of the main cables of Fairmount Suspension Bridge (Philadelphia), erected by Ellet about 1840—one from near the centre of the span and the other from over the top of the tower—which, with a communication from the donor, Mr. Joseph M. Wilson, of Philadelphia, referring to them, were presented to the Society.

NOVEMBER 4TH, 1874.—THE TWENTY-SECOND ANNUAL MEETING was called to order at 11 o'clock A. M., Mr. Julius W. Adams, President, in the chair. The following were present during the session:—Messrs. Samuel C. Ellis and Gorham P. Low, Jr., of Boston, Mass.; George C. Tingley, of Providence, R. I.; Theodore G. Ellis and Charles B. Richards, of Hartford, Conn.; Charles H. Fisher and William J. McAlpine, of Albany; Julius W. Adams, Francis Collingwood, Wilson Crosby, John Y. Culyer, Thomas P. Kinsley, Charles C. Martin, Samuel R. Probasco and Robert Van Buren, of Brooklyn; John Avery, John G. Barnard, Arthur Beckwith, Leonard F. Beckwith, H. Bissell, John Bogart, Alfred P. Boller, Jacob M. Clark, Robert L. Cooke, Alfred W. Craven, J. James R. Croes, P. P. Dickenson, Charles E. Emery, M. N. Forney, Charles K. Graham, George S. Greene, Charles M. Harris, G. Leverich, Charles Macdonald, William W. MacLay, James O. Morse, John Schuyler, William H. Searles, John D. Van Buren, Jr., Edgar B. Van Winkle and William E. Worthen, of New York, and W. W. Wilson, of Yonkers, N. Y.; Cook Talcott, of High Bridge; Arthur Speilmann, of Hoboken; Richard D. Dodge, Charles D. Ward and Lebbeus B. Ward, of Jersey City; James Owen and Eugene Vanderpool, of Newark, and Samuel H. Shreeve, of Tom's River, N. J.; Thomas C. Clarke, S. T. Fuller, E. D. Leavitt and Franklin C. Prindle, of Philadelphia, and J. Dutton Steele, of Pottstown, Pa.; William R. Hutton, of Baltimore, Md., and John B. Dunklee, of Washington, D. C.

The Annual Report of the Board of Direction\* on the affairs—and of the Treasurer on the finances, of the Society, were read and accepted.

The vote on admission to membership was canvassed, and the following declared elected :—Member, Mr. Thomas Stratford, of Brooklyn, N. Y.; Associate, Prof. Robert Fletcher, of Hanover, N. H., and Juniors, Messrs. Stephen Pierson, of Meriden, Conn.; Charles H. Tasker, of Cincinnati, O., and Theodore F. Wurtz, of Northampton, Mass.

The Society proceeded to elect officers for the ensuing year; ballots were taken and the following declared elected :

Messrs. JULIUS W. ADAMS, President;

W. MILNOR ROBERTS and THEODORE G. ELLIS, Vice-Presidents;

GABRIEL LEVERICH, Secretary;

JAMES O. MORSE, Treasurer;

OCTAVE CHANUTE, JOHN BOGERT, CHARLES MACDONALD, FRANCIS COLLINGWOOD and GEORGE S. GREENE, Directors.

A recess for one half hour was taken.

The meeting was called to order at 2 o'clock p. m.

The amendment to the By-laws, Section 23,† submitted at the last regular meeting of the Society, was taken up; the President, as Chairman of the "Committee on a Revised Constitution," presented a report thereon,‡ and the proposed section was adopted instead of the one in force.

On the recommendation of the Board of Direction, the fee henceforth to be paid by Fellows, under Article XXVI of the Constitution, was reduced from \$250 to \$150.

The President, for the "Board of Censors to award the Norman Medal," reported :

"The undersigned, a Board of Censors to select from the papers submitted in competition for the Norman Medal, such one as in their judgment best meets the views of the founder and the true interests of the Society, beg leave to report, that the 'Memoir on the Construction of a Stone-Dam,' a paper submitted without other mark of identification, is entitled to the Norman Medal for 1874."

"JULIUS W. ADAMS, President American Society of Civil Engineers."

"JOHN G. BARNARD, Colonel of Engineers and Brevet Maj.-General U. S. A."

The sealed envelope accompanying the paper named was opened, and Mr. J. James R. Croes, of New York, declared the successful competitor.

Mr. Alfred P. Boller, Chairman of the Committee on "Time and Place of the Seventh Annual Convention," made a report, which was accepted.§ Communications from Mr. William P. Shinn, of Pittsburgh, and others, relating to the matter, were read. A discussion followed, and it was determined that the Convention should be held June 9th and 10th next, at Pittsburgh, Pa.

A report of progress from Mr. W. Sooy Smith, Chairman of the Committee on "Tests of American Iron and Steel,"‡ was presented and accepted; and, to promote the objects in view, the Committee was re-

\* Page 146.

† Page 132.

‡ Page 160.

§ Page 161.



quested to arrange for a general meeting of members of the Society, in Washington, during the next session of Congress.

Mr. Thomas C. Clarke, of the Committee on the "Means of Averting Bridge Accidents," stated that a report had recently been prepared by one member, which, from lack of time, had not been examined by others of the Committee, and under advice of his colleagues present, he would simply report progress.

Mr. John Bogart, Chairman of the Committee on a "Change of the Society's Rooms," presented a report\* which was accepted, the Committee continued and the Board of Direction instructed to secure more commodious quarters for the Society, at the expiration of the lease of the rooms now occupied.

The Committees—on a "Plan for the Increase, Maintenance and Preservation of an Engineering Library and Museum;" on a "Comparative Examination of the principal Pumping Engines in Use;" on "Founding a Testing Laboratory;" on "Securing a national Recognition of the Society," and on "Railway Signals;" severally made reports of progress.

#### OF THE BOARD OF DIRECTION.

OCTOBER 19TH, 1874.—A special meeting for the consideration of the Annual Report was, pursuant to adjournment, held at 2½ o'clock P. M.

The Treasurer submitted a design for a diploma or certificate of membership, which was approved and the engraving ordered to be made.

OCTOBER 26, 1874.—A special meeting for the consideration of the Annual Report was, pursuant to adjournment, held at 2½ o'clock P. M.

NOVEMBER 2D, 1874.—A special meeting for the consideration of the Annual Report was, pursuant to adjournment, held at 2½ o'clock P. M.

The amount of Fellowship fee was considered, and the Board determined to recommend to the Society that at the Annual Meeting, November 4th, the fee henceforth to be paid by Fellows, under Article XXVI of the Constitution, be reduced from \$250 to \$150.

NOVEMBER 9TH, 1874.—A meeting, pursuant to Article VII of the Constitution, was held at 2½ o'clock P. M.

The President appointed Standing Committees for the ensuing year, as follows: on Finance, Messrs. John Bogart, W. Milnor Roberts and Theodore G. Ellis; and on Library, Messrs. Charles Macdonald, O. Chanute and Francis Collingwood.

\* Page 161.

THE  
ANNUAL REPORT OF THE BOARD OF DIRECTION.

ACCEPTED NOVEMBER 4TH, 1874.

The Board of Direction, in compliance with Article XII of the Constitution, herewith presents "a Report on the affairs of the Society, embracing the Report of the Treasurer" for the year ending this day.

On November 5th last the membership was

Honorary Members Resident,	1—Non-Resident,	5—total	6
Members " 108—	" 221—	" 329	
Associates " 6—	" 11—	" 17	
			346
Fellows 77 : of whom 13 were Members, 1 was Honorary Member and 1 deceased, leaving			62
Total then connected with the Society			414

To-day the membership is

Honorary Members Resident,	2—Non-Resident,	5—total	7
Members " 107—	" 248—	" 355	
Associates " 5—	" 10—	" 15	
Juniors " 2—	" 5—	" 7	
			377
Fellows 76 : of whom 13 are Members, 1 is Honorary Member, and 1 deceased, leaving			61
Total now connected with the Society			445
On November 5th last, the number of proposals and applicants for admission to the Society, not acted on was			27
The number of applicants during the year was			63
			84

Of this number, 37 were elected as Members, 11 as Juniors, 9 were withdrawn, 4 declined and 21 are pending. 10 Members elected before November 3d, qualified; and of the 37 elected afterward, 36 qualified and 1 has to qualify. Of the 11 Juniors elected, 7 qualified and 4 have to qualify. One Member (Mr. Horatio Allen, Past President) was elected Honorary Member, and one Associate elected as Member.

The increase during the year has been

Honorary Member.....	1
Members qualified 47—less 14 declared to be no longer Members, 1 made Honorary Member, 1 resigned and 5 deceased.....	26
Juniors qualified.....	7
	<hr/>
	34
Less 1 Associate made Member, and 1 resigned.....	2
Also 1 Fellow deceased.....	1
	<hr/>
	3
Total.....	<hr/>
	31

At the meeting of the Board of Direction, held January 5th, 6 Resident and 8 Non-Resident Members were, under Article XXXI of the Constitution, declared to be from December 23d last, no longer of the Society.

Of the Society, 23 meetings were held during the year, one of which was the Sixth Annual Convention, 11 were in the afternoon and 11 in the evening. No meetings from July 1st to September 2d, were held.

The afternoon meetings, held on the first Wednesday of the month, were the regular meetings, at which ballots for members were canvassed, and other business was done; the evening meetings, held on the third Wednesday of the month, were "for professional improvement and the encouragement of social intercourse among men of practical science, at which papers" were "read and subjects discussed relating to the theory and practice of engineering, and no other business" done.

The attendance on these evening meetings and the interest manifested still continues to increase; if they were held in a more accessible part of the city than here, doubtless many members who now are rarely present, would generally attend.

Of the Board of Direction, stated meetings have been regularly held on the Monday preceding the first Wednesday in each month, and special meetings on five other occasions.

The Sixth Annual Convention was held in this city, June 10th and 11th, 1874, followed by visits to points of interest here and an excursion to the coal fields of Pennsylvania. The formal sessions took place on the first day as a special meeting of the Society, for the reading of papers, submission of reports, discussion of professional subjects, and any recommendation for the future action of the Society.

The number of Civil Engineers in attendance was greater than ever before; the papers and reports presented, with the discussions thereon, have appeared in the Transactions.

At the regular meeting held September 3d last, the purposes and results of Annual Conventions were considered, with a view to deduce therefrom something which shall tend to give these assemblages a more distinct and useful character; the report then presented was referred to a committee, and a second report will be made at an early day.

Papers were presented to the Society during the year just ended as follows:

Note on the Resistance of Materials, and

Note relating to Rumford's Determination of the mechanical Equivalent of Heat, by Robert H. Thurston.

Plan for erecting a Draw-bridge Span without false Works, by C. S. Maurice.

Account of the Erection of a Bridge over the Danube, near Vienna, by W. Howard White.

Central Avenue Bridge at Newark, N. J., by Alfred P. Boller.

Experiments on the tensile Strength of Bar Iron and Boiler Plate, by Charles B. Richards.

Proportions of the Heads of Eye-Bars, by Charles Macdonald.

Tests of Bridge Irons, by W. Sooy Smith.

Experiments on the tensile Strength of Steel Wire, by Thomas C. Clarke.

Tests of wrought Iron Beams and Rods, by T. Guilford Smith.  
 Effects of cold on Iron and Steel Rails, by A. D. Briggs.  
 Strength, Elasticity, Ductility and Resilience of Materials of Machine Construction, by Robert H. Thurston.  
 Elements of Cost of Freight Traffic, by O. Chanute.  
 Method pursued in replacing a Stone Pier on a Pile Foundation, by J. Albert Monroe.  
 The approximate Value of a Reduction of ruling or maximum Grades, by John G. Clarke.  
 Tests of Eye-Bars for Iron Bridges on the Erie Railway, by Russell H. Curtis.  
 The mechanical Properties of Materials of Construction, by Robert H. Thurston.  
 Review of Revy's "Hydraulics of great Rivers," by W. Milnor Roberts.  
 Notes on the Flow of the West Branch of the Croton River, by J. James R. Croes.  
 European Railways as they appear to an American Engineer, by W. Howard White.  
 A Memoir on Rails, by Ashbel Welch.  
 Resistance of Beams to Flexure, by John G. Barnard.  
 Draw-bridge Spans and their Turn-Tables, by C. Shaler Smith.  
 Foundations of the Brooklyn Anchorage of the East River Bridge, by Francis Collingwood.  
 The Conflagration now existing in the Coal at the Kidder Slope, by Martin Coryell.  
 The Terredo Navalis, by G. W. R. Bayley.  
 Improvements of the Water Front of New York, by John D. Van Buren, Jr.  
 Utica Lift Draw-bridge, by Squire Whipple.  
 Upright Arched Bridges, by James B. Eads.  
 Education of Civil Engineers, by Thomas C. Clarke.  
 Erection of the Illinois & St. Louis Bridge, by Theodore Cooper.  
 Construction of the Williamsburgh Reservoir, by Emory C. Davis.  
 Underground Drainage in New York, by John Avery.  
 The Weight of Rails and the Breaking of Iron Rails, by O. Chanute.  
 An Accident in Syracuse, N. Y., occasioned by an improperly constructed Truss, by H. Wadsworth Clarke.  
 Rates paid for Labor of various kinds, in 1873-4, by John Bogart and G. Leverich.  
 Efficiency of Furnaces burning wet Fuel, as determined by Experiments on a large Scale, by Robert H. Thurston.

Reports have been made to the Society during the same time, as follows :

Annual Report of the Board of Direction for the Year ending November 5th, 1873.  
 Final Report of the Committee on publishing the Papers of the Society, and  
 Report on Time and Place of the Sixth Annual Convention. Charles Macdonald, Chairman.  
 Report of the Committee to revise the By-Laws. George S. Green, Chairman.  
 Report on Tests of American Iron and Steel. W. Sooy Smith, Chairman.  
 Report on "Memorial of the American Metrological Society." Robert H. Thurston, Chairman.  
 Report on the Course of Instruction in Schools and Colleges, for Students of Engineering.  
 De Volson Wood, Chairman.  
 Report on Founding a testing Laboratory. O. Chanute, Chairman.  
 Report on the Form, Weight, Manufacture and Life of Rails. Ashbel Welch, Chairman.  
 Report on the Failure of the Dam on Mill River. James B. Francis, Chairman.  
 Report on Tests of American Iron and Steel. W. Sooy Smith, Chairman.  
 Report on Annual Conventions, by the Secretary.

Discussions were had on many of these papers and reports when read before the Society—also on the following subjects :

Proportions of Wheels and Rollers under Swing-bridges and other Structures.  
 Introduction of Checks for Baggage.  
 Setting of Cement under Pressure in Pneumatic Foundations.  
 Cost of driving Piles with the Gunpowder Pile-driver, and the Force of its Blow.  
 Alignments of the Hoosac Tunnel.  
 Tests of Materials used in Construction and Testing Machines.  
 Elements of Cost of Railroad Traffic.  
 Experiments on Mixtures of Mortars and Concretes.  
 Proposed Improvement of the Mouths of the Mississippi.

Dams for Reservoirs, should they be of Earth or Masonry ?

The Measurement of Strains by weighted Levers and hydraulic Gauges compared.

Most of these—and the following papers presented before the past last Society year, have been published in the Transactions :

Record of Experiments showing the Character and Position of neutral Axes as seen by polarized Light, by Louis Nickerson.

Retaining Walls, an attempt to reconcile Theory with Experiment, by Casimer Constable.

Pneumatic Foundations, by W. Sooy Smith.

Account of the Operations of the Gunpowder Pile-driver, by Samuel R. Probasco.

Tests of Bridge Irons, by J. Dutton Steele.

Notes on the crushing Strength of American Irons, by Thomas C. Clarke.

Detroit River Tunnel, by E. S. Chesbrough.

The Production of Traffic and the Transportation of Freight and Passengers, by Martin Coryell.

Back Water in Streams as produced by Dams, by De Volson Wood.

Water-power of the Falls of the Ohio River, by Morris S. Belknap.

Iron Hulls for western River Steamboats, by Theodore Allen.

Foundations of the new Capitol at Albany, N. Y., by William J. McAlpine.

Tables of the Strength of Cast-iron Columns, by Edwin Thacher.

Foundations under Water, by Gabriel Jordan.

The Causes of the Formation of Bars at the mouths of Rivers, as shown by an Examination of the Connecticut River, by Theodore G. Ellis.

Economy of Railroad Curvature, by Wilson Crosby.

At the last Annual Meeting it was determined to issue, under the direction of the Committee on Library, a publication on the second Wednesday of each month, of not less than 48 octavo pages, such to contain—papers submitted and discussions thereon; abstracts of the proceedings of the Society and of the Board of Direction; reports and other communications from the Society to members, and professional enquiries and replies from members themselves; a current list of new scientific and engineering books, with brief examinations of the more important; a list of additions to the Library and Museum during the preceding month; announcements of meetings to be held, papers read and topics discussed, and select advertisements.

In compliance therewith, 12 numbers have been issued of the "Transactions of the American Society of Civil Engineers," at a cost, for 1,000 copies each, as follows :

For printing.....	\$2,161 65	
illustrating.....	778	
copyright.....	6 00	
Total gross cost.....		\$2,945 77
Deduct received and due for printing and illustrating.....	\$242 00	
"        "        for 46 pages of advertisements.....	496 09	
		738 09
Making net cost of 610 pages, including 5 "insets" of tabular matter and 39 plates.....		\$2,207 68

In the reports of the "Committee on Publishing the Papers of the Society," adopted September 17th and November 5th, 1873, the cost of 1,000 copies, 50 pages each month or 600 pages per annum, was estimated at \$2,248.20, which, it will be seen, is somewhat in excess of the real net cost as given above.

The publication has been made in two distinct parts, each pagged by itself, the first being *Transactions*, containing the papers read and discussions had before the Society relating to the theory and practice of engineering, and the second being *Proceedings*, and containing the other less valuable matter.

For the year *Transactions* contain 41 papers, together numbering 432 pages, of which the discussions take 73; there are 5 sheets of tabular matter, 15 folding and 14 full page plates, and 34 wood-cuts. The *Proceedings* contain, in addition to the reports mentioned:

Address of the President, Julius W. Adams.  
 Admissions to the Society during the Year.  
 Amendments to the Constitution and By-Laws.  
 Announcements of Meetings to be held, Topics discussed, &c.  
 Code of Rules for the Award of the Norman Medal.  
 Book Notes.  
 List of Additions to the Library and Museum during the Year.  
 List of new engineering and technological Books published since July 1st, 1873.  
 List of Subjects for Papers.  
 Notes on Memoranda—Short articles on—  
   Buffalo International Bridge.  
   Charges for engineering Services.  
   Cost of Railroad Traffic.  
   Granite Mill Disaster at Fall River, Mass.  
   Introduction of Checks for Baggage.  
   Laying out Railroad Curves.  
   Measurement of Strains in testing Machines.  
   Mixtures of Mortars and Concretes.  
   Practical Questions in Bridge Construction.  
   Strength of Bessemer Steel.  
   Tests of American Iron and Steel.  
 Proceedings of the Board of Direction and the Society for the Year.

Vol. II of *Transactions* was closed with the April number, and an Index and Title Page therefor included in the next number.

A new edition of the Constitution and By-Laws of the Society was published and issued as a supplement to February Transactions.

By the courtesy of Mr. William E. Worthen, Chairman of the Board of Engineers to test the pumping engines for the Lynn Water Works, a copy of the report thereon was issued to members as a supplement to the July number. It is hoped this precedent may be followed, and reports of engineering works or operations, thus distributed among those of the profession who value and will preserve them.

At the meeting of the Board of Direction, December 1st, 1873, the Committee on Library was instructed to prepare a list of subjects relating to the practice of engineering and its connection with kindred arts and public affairs, on which papers shall be solicited and discussions had, and to make timely announcement to the Society of the order in which these subjects will be taken up, so that non-residents may take part.

Such a list was adopted January 5th, and printed in the Transactions for that month, with a request to members that they prepare

papers upon such of the topics named as may be within their several experiences, and give early notice of their intention to do so.

Subjects to be taken up at the meetings of the Society have also been regularly announced in advance, and lately, in two instances, advance copies of the papers to be discussed have been sent to members likely to be familiar therewith, with a request to present their views thereon, either in person at the meeting set down for considering the matter, or by written communication. The success of the experiment in securing a breadth of view, which, when founded on experience, is essential to completeness of knowledge, seems to warrant the adoption of this plan as a regular means of facilitating discussion.

During the past Society year, the Library has greatly increased, mostly by the contributions of members and others interested in its growth. In April, by order of this Board, a circular was sent out, asking the donation of new and old reports, odd pamphlets and similar matter, which may form a basis for the history and comparison of engineering operations. In response, there has been contributed books and pamphlets of great value now, to those engaged in engineering research, and which by increasing rareness will become more so, year by year.

There has been added to the Library and Museum during the year :

Books bound—purchased. 19 ; donated, 343 ; total.....	362
“ unbound and pamphlets.....	707
Manuscripts.....	2
Maps, plans, drawings and charts.....	251
Photographs and engravings.....	64
Models and specimens.....	27

This does not include magazines and papers contributed to the Society by their respective publishers, or received in exchange for the Transactions—as follows :

Annales des Ponts et Chaussées.....	Quarterly,	Paris.
Deutsche Bauzeitung.....	Weekly,	Berlin.
Engineer and Surveyor.....	“	Chicago.
Engineering.....	“	London.
Iron.....	“	“
Journal of the American Iron and Steel Association.....	“	Phila.
Journal of the Society of Arts.....	“	London.
Monthly Record of Scientific Literature.....	Monthly,	New York.
Official Gazette of the United States Patent Office.....	Weekly,	Washington
Railroad Gazette.....	“	New York.
The American Chemist.....	Monthly,	Phila.
Builder.....	Weekly,	London.
Building News and Eng. Journal.....	“	“
Chicago Railway Review.....	“	Chicago.
Commissioners of Patents Journal.....	Semi-weekly,	London.
Engineer.....	Weekly,	“
Engineering and Mining Journal.....	“	New York.
Iron Age.....	“	“
Journal of the Franklin Institute.....	Monthly,	Phila.
Manufacturer and Builder.....	“	New York.
Popular Science Monthly.....	“	“
Van Nostrand's Eclectic Engineering Magazine.....	“	“



Book lists as follows are subscribed for :

Allgemeine Bibliographie für Deutschland.....	Weekly,	Leipzig.
Bibliographie de la France.....	"	Paris.
Bookseller.....	Monthly,	London.
Publishers' Weekly.....	Weekly,	New York.

The Society has received in exchange for its Transactions, the official publications, in sets more or less complete, of the following scientific and engineering associations :

American Institute of Architects, New York.  
 American Institute of Mining Engineers, New York.  
 Association of Civil Engineers of Portugal, Lisbon.  
 Association of Engineers and Architects of Austria, Vienna.  
 British Patent Office, London.  
 Boston Public Library, Boston.  
 Engineers' Club of St. Louis.  
 Engineers' Club of the Northwest, Chicago.  
 Essayons' Club, U. S. A., Willet's Point.  
 Institution of Civil Engineers, London.  
 Institution of Engineers and Shipbuilders of Scotland, Glasgow.  
 Institution of Mechanical Engineers, Birmingham, England.  
 Iron and Steel Institute, London.  
 Railway Association of America, St. Louis.  
 Saxonian Society of Engineers and Architects, Dresden.  
 Society of Engineers, London.  
 Societie des Ingenieurs Civils, Paris.

Also, at the cost of binding—

Specifications and Drawings of U. S. Patents.

Including the serials received during the year, and making altogether 40 unbound volumes, the present state of the Library is as follows :

Books bound.....	1,637
" unbound and pamphlets.....	2,263
Manuscripts.....	83
Maps, plans, drawings and charts.....	595
Photographs and engravings.....	281
Models and specimens.....	122

At the meeting September 3d last, Mr. Robert N. Brown presented to the Society, as a valuable record of one phase in the history of railroads, a manuscript copy of the "Report on the proposed Change of Gauge of the New York & Erie R. R.," from 6 feet to 4 feet 8½ inches, made in February, 1847, by Mr. T. S. Brown, late Chief Engineer of that road.

As yet, this Society has bought but few books—expenditures for the Library have been limited chiefly to the purchase of cases, and the binding of serial publications. There are, however, often in market rare or valuable copies of works, indispensable to anything like a complete collection of engineering books, which at the time may be had at a low cost. Many pamphlets and unbound books now in the Library, need binding to render them as serviceable as they should be to members who wish to consult them ; it seems, therefore, well to consider whether a certain specific proportion of the Society's income should not be set

apart and appropriated to the increase and maintenance of the Library . to bind in substantial style, reports, pamphlets, serials and other works of permanent value which may require it ; purchase standard books of reference for engineers, and to procure rare professional works, when offered at low rates.

Attention may here be called to the need of greater accommodation for the Library—either in these or other rooms ; much of the matter now on hand is difficult of access, and the regular increase by contributions of members and others, renders the embarrassment from the lack of room, greater day by day.

At the regular meeting on April 1st, the expediency of a change in location of the rooms of the Society, was referred to a committee to obtain requisite information and report to the Board of Direction ; the report was duly presented, accepted and published in the Transactions ; a second committee was appointed to confer with kindred associations in New York, select chambers in a central location for occupancy after the existing lease expires, and in due time report to the Society. Members opposed to a change were requested to state their reasons therefor—as yet no one has so done.

The Committee on Library, under instructions of the Board, has in consideration a scheme for the division of the books, maps and similar property of the Society into works of reference which shall not be removed from these rooms, and works which may be loaned to members ; how far this may be practicable with the Library in its present state is a question ; duplicate copies, however, may be loaned without objection.

The committee appointed to arrange with Mr. George H. Norman the details necessary to perfect his plan to award a medal each year for the best essay on engineering subjects, reported to the Board, March 2d, a Code of Rules for the award, which were published in Transactions for April, and under which, formal announcement was made that papers in competition for this prize of merit would be received.

By the Code, the President of this Society, the President of Columbia College, and the engineer officer of the U. S. Army, commanding in that capacity, in New York city and vicinity, are *ex officio* a Board of Censors to make the award. This Board, consisting of Messrs. Julius W. Adams, F. A. P. Barnard and John G. Barnard has entered upon its duties, and will report at this meeting.

The dies for the medal are complete, and deposited with the Director of the U. S. Mint, Philadelphia, subject to the order of the Treasurer of the Society.

Committees at the beginning of the past Society year, charged with the examination of special professional subjects, were as follows :

“ On Tests of American Iron and Steel ;” appointed June 6th, 1872, “ to urge upon the United States Government the importance of a

thorough and complete series of tests upon American iron and steel, and the great value of formulas to be deduced from such experiments."\* An informal report was presented and discussed, on November 19th last; a second report, with a "Memorial to Congress," setting forth "the importance of these tests and the advantages to be derived from them," was adopted at the late Annual Convention, and the Committee continued; a report of progress will be presented at this meeting.

"On the Form, Weight, Manufacture and Life of Rails;" appointed January 8th, 1873, to determine "the best form of standard rail sections of this country; the proportion which the weight of rails should bear to the maximum loads carried on a single pair of wheels of locomotives or cars; the best methods of manufacturing and testing rails; the endurance or 'life' of rails; the causes of the breaking of rails and the most effective way of preventing it, and the experience of railways in this country in the use of steel rails."† At the last Annual Convention an extended report was presented, discussed and accepted, and the Committee continued.

"On the Means of averting Bridge Accidents;" appointed May 22d, 1873, "in view of the calamitous disaster of the falling of the bridge at Dixon, Ill., and other casualties of a similar character, to report the most practicable means of averting such accidents."‡ At the last Annual Convention a report of progress was made and the Committee continued. By personal intercourse and correspondence, an interchange of views has been had between the members of the Committee, and a final report is expected at an early day.

"On a Plan for the Increase, Maintenance and Preservation of an Engineering Library and Museum;" appointed July 2d, 1873, "to devise a plan whereby such a Library may be founded; the funds obtained for its collection, management, increase and maintenance; a suitable place secured where it and other possessions of the Society may be preserved, and its advantages enjoyed by members and others, irrespective of location.§ This Committee has the matter with which it is charged under consideration, and expects to report soon.

Committees for similar objects appointed during the Society year, were as follows:

"On what should be the Course of Instruction in Schools and Col-

\* Messrs. W. Sooy Smith, of Chicago, John G. Barnard and George B. McClellan, of New York; James B. Eads, of St. Louis; Albert Fink, of Louisville; Robert H. Thurston, of Hoboken; Charles B. Richards, of Hartford, and Otho E. Michaelis, of Pittsburgh, Committee.

† Messrs. Ashbel Welch, of Lambertville (N. J.), M. N. Forney and Octave Chanute, of New York, and J. M. St. John, of Quinnamont (W. Va.), Committee.

‡ Messrs. James B. Eads and C. Shaler Smith, of St. Louis; I. M. St. John, of Quinnamont (W. Va.); Thomas C. Clark, of Philadelphia; James Owen, of Newark (N. J.); Alfred P. Boller, O. Chanute and Charles Macdonald, of New York; Julius W. Adams, of Brooklyn, and Theodore G. Ellis, of Hartford, Committee.

§ Messrs. Julius W. Adams, of Brooklyn; E. S. Chesbrough, of Chicago; Alfred P. Boller, James O. Morse and G. Leverich, of New York; Thomas C. Clarke, of Philadelphia; Charles Herman, of Louisville; Charles Paine of Cleveland, and Theodore G. Ellis, of Hartford, Committee.

leges, for Students in Engineering," appointed February 4th, last; \*\* a report was presented and adopted May 6th, and the Committee discharged.

"On a Memorial of the American Meteorological Society," in which Congress is asked to take action to insure, wherever practicable, a prompt adoption of a decimal system of weights and measures; appointed February 18th last. † A report was presented, discussed and laid on the table, May 6th following.

"On a comparative Examination of the principal Pumping Engines in Use," appointed April 1st last. ‡ A circular has been sent out asking for detailed information of pumping engines, from replies to which and other data obtained a report will be prepared.

"On the Founding of a testing Laboratory, for making complete and impartial tests of the characteristics, value and strength of materials used in the arts," appointed April 15th last. § A report was presented and adopted June 3d following, and the Committee continued to consult with other committees appointed by kindred bodies, fix upon a plan of organization and the means of carrying it out.

"On the Failure of the Dam on Mill River," appointed May 20th last, "not only to determine who were in fault, but also to assert the existence of the Society as a body which purposes to exhibit the true causes of the failure of public works, and the engineering ability of those engaged in their construction." || A report was presented, discussed and adopted at the Annual Convention, and the Committee discharged.

"On securing a national Recognition of the Society, by federal Charter or otherwise," appointed June 3d last. \*\* An informal report was made at the Annual Convention, and the Committee continued; a second report will be presented at this meeting.

"On Railway Signals," appointed June 16th last, "to enquire into the various signals in use upon the several railways of the United States." †† A circular has been sent out asking specific information from railroad managers and others, and the Committee is engaged in collecting the materials for a report.

"On rapid Transit for Passengers and the Handling of Freight," appointed September 3d last, "to investigate the necessary conditions of success and to recommend plans for the best means of rapid transit

\* Messrs. De Volson Wood, of Hoboken; Charles Macdonald and George W. Plympton, of New York, Committee.

† Messrs. Robert H. Thurston, of Hoboken; Edward P. North and J. James R. Croes, of New York, Committee.

‡ Messrs. Gorham P. Low, Jr., of Boston; John Bogert, W. Milnor Roberts and William E. Worthen, of New York, Committee.

§ Messrs. O. Chanute, Alfred P. Boller and Richard H. Buel, of New York, Committee.

|| Messrs. James B. Francis, of Lowell; Theodore G. Ellis, of Hartford, and William E. Worthen, of New York, Committee.

\*\* Messrs. Julius W. Adams, of Brooklyn; W. Milnor Roberts, of New York, and Theodore G. Ellis, of Hartford—(the President and Vice-Presidents of the Society), Committee.

†† Messrs. J. Dutton Steele, of Pottstown (Pa.), O. Chanute, of New York, and Charles H. Fisher, of Albany, Committee.

for passengers and the best and cheapest methods of delivering, storing and distributing goods and freight in and about New York."\* This Committee is now engaged in the work assigned.

At a meeting of the Society, December 4th, 1872, on recommendation of this Board, the fee under Article XXVI of the Constitution, to be paid by Fellows admitted after February 1st, 1873, was increased from \$100 to \$250; no subscriptions to the Fellowship Fund have since been received, in view of which fact, the Board, on November 2d last, determined to recommend to the Society in Annual Meeting, that on and after this day, the fee be reduced to \$150.

The Society, on recommendation of this Board, determined on January 7th last, that for Junior (the new class of members) the entrance fee be \$20, and the annual assessment \$10—being the same as for Associate.

At the last Annual Meeting, amendments to the Constitution were adopted, making a third or Junior class of members of the Society, defining the qualifications of each class, the manner of proposing and electing candidates, and prescribing how further amendments shall be made.

A committee was then charged with the revision of the By-Laws to make them correspond with the amended Constitution; the committee reported December 3d last, and the By-Laws recommended for adoption were adopted January 7th following.

The committee of the Board appointed October 15th, 1873 (and continued November 11th following) to prepare a draft of an amended Constitution to be presented to the Board at some future day, on October 5th last, submitted as satisfying present requirements, an amendment to Section 23 of the By-Laws; which was by order of the Board subsequently presented to the Society for adoption, and may be called up for vote this day. The intent of the changes recommended is to still more strictly define the qualifications for admission to the Society, and thereby elevate the standard of membership in the several grades.

The distinctive features thus introduced into the organic law of the Society were the change in the name of the class heretofore called Associate to Junior; establishing a third class called Associate, of those "qualified to co-operate with Civil Engineers in the advancement of professional knowledge;" determining the qualifications of those admitted to either class; and the adoption of the letter ballot, whereby Members may vote by letter on the admission of new members, or the adoption of further amendments to the Constitution.

A form was determined on, such that the votes cast are canvassed with the secrecy of the ballot—so essential to the integrity of an association like this—strictly preserved; it not being at any time practicable for one member to discover how another votes, if the latter observes the rule prescribed and printed on the ballots as distributed.

\* Messrs. O. Chanute, M. N. Forney, Charles K. Graham and Francis Collingwood, of New York, and A. Welch, of Lambertville (N. J.), Committee.

This form was used for all elections of members had during the Society year just ended—in some cases 160 votes were canvassed, and after the trial of the system thus made, this Board has no change in the plan or its application to recommend.

In consequence of the change in classification the following circular was issued by order of the Board to those who were then termed Associates :

"SIR :—A change in the Constitution of the American Society of Civil Engineers, adopted at the late Annual Meeting, provided for a new grade of membership in addition to those then existing."

"This new grade is to designate and class those persons whose connection with science and the arts qualifies them to concur with Civil Engineers in the advancement of professional knowledge ; these are to be styled Associates."

"The grade of membership heretofore designated Associate is continued as in the past, but the designation is changed to Junior."

"It will be seen that under these changes in the Constitution, the members heretofore designated as Associates, may not be properly styled, but rather will belong to the class of Juniors."

"Will you please signify to the Society your consent that your membership be so designated? Or if you are eligible as Member, under the Constitution, and desire to be transferred to that class, will you present your application as early as possible, in order that the new classification may be completed?"

But one Associate signified a desire to change his classification (and in due time he was transferred and elected a Member). From this and other facts brought to the knowledge of the Board, it seemed important that the term Junior as referring to membership, should be defined, wherefore the note added to clause 5 of the section proposed as an amendment to the By-Laws, as follows ; "the term Junior is to be understood as not referring to the age of the person but to his classification in the Society for the time being ; he is *junior* to Members in the sense that his professional experience has had a more limited scope than theirs, whilst he is eligible to become a Member which an Associate is not" ; also the conditions that the age of Juniors should not be limited in the qualification prescribed, and that an Associate should not be practicing as an Engineer.

The form of application for admission to the Society was made consistent with the requirements of the Constitution and By-Laws as lately amended ; whence a candidate, whether as Member, Associate or Junior, shall apply with statement of professional experience over his own signature, and agree to conform to the requirements of membership, if elected.

The method of examination into the qualifications of candidates is as follows ; on receipt of an application, the Secretary examines it to see that it is in due form ; if not, it is returned to the applicant or his proposers, with a request that proper corrections be made ; if correct, it is submitted to the Committee of the Board of Direction on Admissions (consisting of the President, Secretary and Chairman of the Finance Committee), and a report thereon made to the Board. Upon this and the statement of professional service submitted, the Board determines



upon the eligibility and classification of the candidate, and may order a ballot to be taken ; if, however, the application is for admission into a class different from that recommended by the Board, the applicant is informed as per following circular .

" SIR :—The Board of Direction having considered your application for admission to this Society as \_\_\_\_\_, from the information contained in the statement of professional service submitted, reports that under the Constitution and By-Laws you are eligible as \_\_\_\_\_, and if such is acceptable to you, will order a ballot to be taken.

" Please express, upon the annexed blank, your consent, or state why the application should be reconsidered.

" Respectfully,

" Secretary."

" If classification is accepted, sign this form."

" I will accept admission to the American Society of Civil Engineers as \_\_\_\_\_ and if elected, will conform to the requirements of membership.

" Respectfully,

" Applicant."

" If classification is not accepted, fill out and sign this form."

" I ask that for the following reasons, my application for admission to the American Society of Civil Engineers be reconsidered."

" Applicant."

If classification is not accepted, upon receipt of the above duly filled out, the application is reconsidered.

When the ballot is ordered to be taken, the following is sent out:

" BALLOT LIST. The vote will close \_\_\_\_\_ To vote Nay draw the pen through *aye*. Two envelopes are sent with the List, place it in the smaller one, seal that and enclose in the larger one. Write your name across the back of the ballot, after it is sealed, and forward as addressed."

(Then follows a classified list of candidates with *aye* opposite each name, their engagement, residence and proposers, and afterwards—)

" The Board of Direction having considered the proposals of the foregoing for admission to the Society, report that the candidates are eligible under the Constitution and By-Laws and recommend them for ballot."

" Secretary."

From what has been stated it will be seen that the qualifications of admitted members are defined by the Constitution and By-Laws ; the applicant must affirm in detail that he, by length and quality of service possesses them ; two Members of the Society must certify to his statement and that they, from personal knowledge, believe him to be in all respects a proper person to be admitted to the Society ; the Secretary, Committee on Admissions and Board of Direction examine the application, and the latter determines if it entirely conforms to the requirements. A ballot is then sent to each Member, who can vote *aye* or *nay*, as in his judgment, what he personally knows of the fitness of the candidate for membership may be favorable or not, and *three negative votes* prevent an election.



There is, consequently, no good reason why an ineligible, incompetent or unworthy person should be admitted; the influence and dignity of the Society, as well as the integrity of the profession it seeks to elevate and conserve, demand that in official or personal capacity, each Member shall conscientiously discharge his duty in this matter. It is to be understood that the Board of Direction passes on the personal qualifications of members, solely under the requirements of the Constitution and By-Laws; the election of such rests with the individual Members by their ballots.

By resolution of the Board January 29th, and confirmed November 11th, 1873, the Treasurer was made a Committee, to procure a seal, book-mark and diploma of the Society. On October 19th last, he presented a model of the latter which was adopted, and he was instructed to have the same engraved and prepared for distribution to members. Its text is as follows:

"The American Society of Civil Engineers by this Diploma certifies that \_\_\_\_\_ is a \_\_\_\_\_ of said Society, and fully entitled to all the privileges granted in its Constitution."

"Attest (Seal.) \_\_\_\_\_

President.

\_\_\_\_\_  
"Secretary.

"Date of membership \_\_\_\_\_

The general Report of the Treasurer of the Society on the state of its finances for the year ending this day is appended.\*

During the year the Society has mourned the loss of:

John B. Rogers, C. E., of St. Louis, Mo., admitted as Member, August 4th, 1873, who died April 1st, 1874.

William Phillips, Esq., of Pittsburgh, Pa., admitted as Fellow, March 23d, 1870, who died April 14th, 1874.

Jonathan Camp, C. E., of Jersey City, N. J., admitted as Member, December 31st, 1873, who died April 16th, 1874.

J. Milton Brown, C. E., of Auburn, N. Y., admitted as Member, April 7th, 1874, who died June 16th, 1874.

T. Marr Johnson, C. E., of London, England, admitted as Member, February 26th, 1872, who died July 31st, 1874; and

Isaac C. Buckhout, C. E., of New York, admitted as Member, July 15th, 1872, who died September 27th, 1874.

Memoirs of the deceased are appended to this report.\*

Respectfully submitted,

G. LEVERICH,

Secretary.

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\* To be published in December Transactions.

## REPORTS OF COMMITTEES.

### ON A REVISED CONSTITUTION.

PRESENTED NOVEMBER 4TH, 1874.

The Committee would beg leave to report, that after a careful consideration of the subject, it fails to see a necessity at this time of any change in the Constitution.

It is desirable that the impress of stability should attach to all which pertains to the organic law of the Society. This can never be the case, so long as the little embarrassments and imperfections inseparable from the working of so complicated a machine as a Society whose members are spread over a continent, are sought to be remedied from time to time by changes in its Constitution. These difficulties in working can be met by a more simple process—regarding any change in the Constitution as a question only to be considered in the last extremity.

The ground work of the present Constitution was the result of no small amount of labor and careful consideration, and it has stood the test of trial very well. With the exception of some verbal changes, all amendments have thus far grown out of the necessities of our progress; and as it stands, the instrument provides for our present, and so far as we can judge, our future wants—for some time to come. Some changes in phraseology could be suggested as possible improvements, but they are too insignificant in their

bearing to be made the occasion of another precedent for change, in a paper which it is believed embodies all that is vital to our organization.

It must be admitted, however, that in defining the qualifications of the several classes of members, some ambiguity exists in the letter of the Constitution; this is sought to be explained by embracing in the By-Laws articles defining more clearly the construction to be put upon certain clauses in the Constitution. In canvassing the application for membership by the Board of Direction, much embarrassment would be avoided did these explanatory articles in the By-Laws really render any plainer what, from the nature of things, did not admit of minute definition in the Constitution—and to meet this want, amendments have been proposed to these articles of the By-Laws, which will be brought up for your action to-day, and which it is believed, if passed in the affirmative, will remove all ambiguity as to the meaning of any questionable clause in the Constitution—leaving the latter instrument intact.

Respectfully submitted,

J. W. ADAMS,  
Chairman.

### ON TIME AND PLACE OF THE SEVENTH ANNUAL CONVENTION.

ACCEPTED NOVEMBER 4TH, 1874.

The Committee on Time and Place of the Seventh Annual Convention of the Society, respectfully reports that on September 22d, a circular was sent to members, asking each to state when and where he would prefer the Convention to be held, and to give his reasons.

In response, 91 replies were received—of these, in respect to the time, 2 named February, 9 May, 51 June, 1 July, 1 September, 1 October and 26 expressed no choice; in respect to the place, 32 named Boston, 1 Cincinnati, 2 Chicago, 1 Cleveland, 6 New York, 7 Philadelphia, 3 Pittsburgh, 2 Providence, 3 San Francisco, 6 St. Louis, 1 St. Paul, 9 Washington, and 18 expressed no choice.

In view of the fact that the time when the

Convention shall be held is somewhat contingent on the place, and there is not a majority of votes in favor of any place named, the Committee submits the following extract from a letter written by one of its members, who is also the Chairman of the Committee on "Tests of American Iron and Steel."

"I would earnestly urge the advisability of holding our Convention in Washington sometime before the adjournment of Congress."

"We are making an effort to secure national recognition, and also endeavoring to obtain from Government the means required to make thorough tests of iron, steel, and other materials largely used in construction."

"One of the very best means of making the

Society known to those whose aid is required to obtain these objects is to meet in Convention at Washington and explain to our personal friends who are officers of the government, the purposes of our organization and the ends we propose."

"It would also be a courteous recognition of the claims of the Southern members, to hold the Convention so far South as may be,

without too great inconvenience to the majority of the Society."

The Committee would close this report by calling attention to replies from other members—giving reasons for their choosing the places named by them.

Respectfully submitted,

ALFRED P. BOLLER,  
Chairman.

## ON TESTS OF AMERICAN IRON AND STEEL.

ACCEPTED NOVEMBER 4TH, 1874.

The Chairman of the Committee on tests of American Iron and Steel begs leave to submit the following *ad interim* report:

Since the Annual Convention of the Society, as Congress has not been in session, no further action has been taken by the Committee toward bringing the matter in charge directly to the attention of our legislators.

The Memorial prepared by the Committee and adopted by the Society, was published at length in August Transactions, and the subject has thus been brought prominently to the attention of all members of the Society, and others who receive this monthly publication.

The Committee has in preparation a letter designed to accompany the Memorial, setting forth at length the manner which is suggested to accomplish the work, the value and importance of which the Memorial was designed to demonstrate. This letter and the Memorial are to be sent to each member of Congress, and to such officers of the Government as are likely to favor the effort and aid with their influence. The letter will contain the material of a bill which the Committee will

undertake to prepare and present early at the next session of Congress.

Both will be supplied to each member of the Society, who will be requested to write to Congressmen or other officers of the Government whom he may know personally, and ask their aid in the passage of the bill.

Notwithstanding that economy in the administration of the Government is demanded by the people, who are passing through the trials incident to the dullness in business consequent upon the panic, it is hoped and believed that the necessity of making the tests is so pressing, and the value of them so great that Congress will not hesitate to make the necessary appropriation. In order to effect this, however, each member of Congress must be so thoroughly informed of the facts as to perceive that the bill formulates a necessity coming home to every citizen, and provides for supplying it.

The aid of the entire Society is asked in getting the subject of the tests thus fully before Congress.

Respectfully submitted,

WM. SOOX SMITH,  
Chairman.

## ON A CHANGE OF ROOMS OF THE SOCIETY.

ADOPTED NOVEMBER 4TH, 1874.

The Committee appointed with reference to a change of the rooms of the Society, begs to report.

That, as directed, it has conferred with several officers of other associations in this city, with regard to the possibility of finding in a desirable locality, such accommodations as would give, at moderate expense, better facilities for the comfortable life of this Society than at present enjoyed. As the leases

both of this and other societies do not expire until May 1st next, and the same is true as to several buildings which have been under consideration as possibly desirable for the future, no definite arrangements have yet been made; the Committee has, therefore, simply to report progress.

In this connection attention is called to a report referring to this matter, made to the Board of Direction, May 4th last, an abstract

of which was published in May Transactions.\*

The Committee only wishes to add the opinion that the experience of the past year has decidedly confirmed the desirability of the change proposed. One point in particular has great weight—that is, the uses of the Library and rooms of the Society will be brought more easily within reach of those non-resident members who may visit the city

if the rooms are nearer the hotels and dwelling parts than now.

If our Library increases as it now promises to do, and access is convenient, our rooms will certainly be more and more a resort, and our evening meetings especially will be of more extended interest.

The Committee is clear in the opinion that suitable rooms can be found at reasonable rent in a desirable location.

JOHN BOGART,  
Chairman.

\* Proceedings, page 86.

## NOTES AND MEMORANDA.

Members are desired to contribute selections from their note books and similar records of experience referring to engineering practice, and those seeking information are asked to suggest professional topics for discussion.

### METEOROLOGICAL OBSERVATIONS AT ALLEGHANY ARSENAL,

PITTSBURGH, PA., FOR JULY, 1874,

including the period of the late disastrous flood in that city:

DATE.	Bar., 7 A. M.	Ther., 7 A. M.	Rain- fall, 7 A. M.	DATE.	Bar., 7 A. M.	Ther., 7 A. M.	Rain- fall, 7 A. M.
Wednesday .. 1	29.40	63	0	Wednesday .. 22	29.45	59	.09
Thursday.... 2	29.30	66	0	Thursday.... 23	29.36	62	.0
Friday..... 3	29.45	65	0	Friday..... 24	29.32	70	.0
Saturday.... 4	29.27	71	0	Saturday.... 25	29.33	75	.0
Sunday..... 5	29.34	67	.1	*Sunday.... 26	29.33	73	.0
Monday..... 6	29.45	65	.0	*Monday.... 27	29.20	72	4.01
Tuesday.... 7	29.36	71	.0	Tuesday.... 28	29.20	67	.95
Wednesday... 8	29.22	74	.35	Wednesday.. 29	29.30	65	.0
Thursday.... 9	29.20	76	.17	Thursday.... 30	29.43	60	.0
Friday..... 10	29.20	76	.28	Friday..... 31	29.31	68	.0
Saturday.... 11	29.26	69	1.12	Total for month.			6.81
Sunday..... 12	29.22	70	.38	* Storm.			
Monday..... 13	29.44	65	.26				
Tuesday..... 14	29.61	70	.0				
Wednesday.. 15	29.47	75	.0				
Thursday.... 16	29.28	77	.0				
Friday..... 17	29.43	62	.0				
Saturday.... 18	29.45	65	.0				
Sunday..... 19	29.54	73	.0				
Monday..... 20	29.46	78	.0				
Tuesday..... 21	29.47	68	.0				

Total Rain Fall.	Ins.	Heaviest 24 hours.	Ins.
July, 1874.....	6.81	July 26-27....	4.01
" 1873.....	3.91	" 15-16.....	1.21
" 1872.....	9.13	" 22-23.....	1.80
" 1871.....	3.28	" 26-27.....	1.01
" 1870.....	6.85	" 24-25.....	1.70

O. E. MICHAELIS.

## ENGINEERING AND TECHNOLOGY.

Under this head will be announced new books on these and kindred subjects published in English, French and German, which may be professionally useful to members of the Society.

The original titles of foreign books noted here will be furnished, on request.

At the present rates of duty and exchange, the cost of imported books may be estimated in federal money, at one shilling equal to 50 cents, and one thaler to \$1.23.

Addresses delivered before the British Association assembled at Belfast; with additions. Prof. John Tyndall. London. 8vo. 3s.

Amazon and Madeira Rivers: Sketches and Descriptions from the Note-Book of an Explorer. Franz Keller, Engineer. London. 4to, illus.

Architectural Studies, (Picturesque)—and practical Designs for Gate-Lodges, Cottages, Cottage Hospitals, Villas, Vicarages, Country Residences, Schools, Village Churches, etc., etc. W. Young. London. 4to, illus. \$10.00.

Architecture, National Cottage—. New and original Designs, working Scale Drawings, and Details for all Styles of low-priced Houses, with Specifications and Cost. Hussey. New York. 4to, illus. \$6.00.

— of Vienna; modern—C. V. Lutzow and L. Fiescher. Vienna (French). Illus. 2½t. Art, elementary History of. An Introduction to ancient and modern Architecture, Sculpture, Painting, Music. N. D'Anvers. Preface by T. Roger Smith. London. 12mo, illus. \$4.00.

Astronomy, Progress in—1870-72 (from the Quarterly Review of Sciences). Leipzig (German). 8vo. 1t.

Atomism. Dr. Tyndall's atomic Theory of the Universe, examined and refuted. 2d ed. Prof. Watts. Belfast. 8vo. 4d.

Bridges—on building Bridges, Viaducts, &c., for Railroads, being a Collection of Examples in Construction. Const. Heinz. Berlin (German). 4to, illus. 5t.

Bridge Structures for Railroads; Tables for the Calculation of the Weights of—, for the practical use of Railroad Engineers. Julius Seefehlner. Pest (German). 8vo, illus. ½t.

Building-Stone, Report on the compressive Strength, Specific Gravity, and Ratio of Absorption of the various Kinds of Building Stones from different sections of the U. S., tested at Fort Tomkins, Staten Island, N.Y., by Gen. Q. A. Gillmore. Corps of Engineers U. S. A. Washington.

Butter: its Analysis and Adulterations, specially treating on the Detection and Estimation of foreign Fats. A. Angell and O. Hehner. London. 8vo. 1s.

Cavalry. The French and Prussian—in the Battle near Vionville and Mar-la-Tour, Aug. 18, 1870. Trans. from the German by T. E. Smith. London. 8vo. 2s.

Ceramic Art, History of—, Llewellynn Jewitt. London. 8vo, illus.

Chain Cables. Report of Committee on the Efficiency of the present Tests for—and anchors, and as to the satisfactory Character of the Regulations under which they are applied. (Parliamentary Report.) London. 1s. 9d.

Chemical Analysis, Commercial Hand-book of—or, practical Instructions for the Deter-

mination of the intrinsic or commercial Value of Substances used in Manufactures, Trades and the Arts. Dr. A. Normandy. New ed. Enlarged and almost re-written by Henry M. Noad. London. Illus.

— Manual of—, W. Dittmar. 2d ed. London. 4to. 5s.

Technology, Elementary Treatise on— Rudolph Wagner. 2d ed. Leipzig (German). 8vo, illus. 1½t.

Chemistry, An elementary Treatise on practical Chemistry and qualitative Inorganic Analysis. Frank Clewes. London. 8vo. 7s. 6d.

— Progress in Theoretical—(from the Quarterly Review of Sciences). Leipzig (German). 8vo. ½t.

Civil Engineering, A Manual of—W. J. M. Rankine. 10th ed., revised by E. F. Bamber. London. 8vo. 16s.

Coloring, A Grammar of—applied to decorative Painting and the Arts. George Field. New ed., enlarged and adapted to the Use of ornamental Painter and Designer, with additional Sections on Painting in Sepia, Water-Colors and Oils, &c., &c. By Ellis A. Davidson. London; illus.

Contracts, Law of—for Works and Services. David Gibbons. New ed., much enlarged and brought down to the present Time. London.

— On Building Contracts: A legal Handbook for Architects, &c. 2d ed. E. Jenkins and J. Raymond. 8vo. 6s.

Creation; or, the dynamical System of the Earth's Formation. Archibald T. Ritchie. 8vo. London.

Drawing, Architectural Drawing Studies, intended as a simple Guide to the Knowledge of ancient Styles of Architecture. A. Rimmer. Preface by J. S. Howson. London. Folio. 2s. 6d.

Free-hand Drawing Book, from Designs by Charles Ryan, R. P. Leitch and A. T. Elwes, with blank Space for copying each Example. Shipping, Landscape, Animals, Flowers, etc. London. 8vo. \$1.50.

— Practical Drawing Book, from Designs by Prof. De la Motte and Ellis A. Davidson. With blank Space for copying each Example. Geometrical, Ornamental and Mechanical. London. 8vo. \$1.25.

Dictionary: Technological Dictionary of the English, French and German Languages, containing about 76,000 technical Terms and Phrases employed in Art, Trade and general Industry. Revised. L. Tolhausen. Part II. English, German, French. Leipzig. 2½t.

Dynamics, Elementary—W. G. Wilson. London. 12mo, illus. 4s.

Earthwork Tables, showing the Contents in cubic Yards of Embankments, Cuttings, &c., of Heights or Depths up to an average of 80 Feet. Joseph Broadbent and Francis Campin. London. 8vo. 5s.

- Encyclopædia, Chambers'—a Dictionary of universal Knowledge for the People. New and revised ed. London. 8vo, illus. (in 65 Parts). Part I. 7s.
- Engineer and Surveyor, Annual Report of the State—of New York, for year ending September 30th, 1873. Albany. 8vo.
- Engineering Notes. F. Robertson. London. 8vo. \$5.00.
- Engineers and Shipbuilders of Scotland, Transaction of the Institution of—1873-4. Vol. XVIII. Glasgow. 8vo.
- Explosive Substances, Report of Parliamentary Committee on—London. 4s. 2d.
- Fortification. Capt. E. D. C. O'Brien. London. Illus. 3s. 6d.
- Gas, Papers relating to the Chartered Gas Co. and the Imperial Gas-light and Coke Co. (Parliamentary Report.) London. 7s. 3d.
- Gems, The Science of—Jewels, Coins and Medals, ancient and modern. Archibald Billing, F.R.S. New ed. revised and corrected. London. 8vo, illus.
- Geology and its Application to the Determination of the Nature of the Soil of the Austro-Hungarian Monarchy. F. Retter Von Haur. Vienna (German). 8vo, illus. 3t.
- for Students and general Readers, embodying the most recent Theories and Discoveries. A. H. Green, M.A. In 2 Parts. London. 8vo, illus.
- , the Progress of—An Address delivered before the Royal Academy of Sciences. Austria, May 30th, 1874. Fred. Hochstetter. Vienna (German). 8vo. 3t.
- Geometry, Euclid simplified in Method and Language—being a Manual of Geometry on the French system. J. R. Morvell. London.
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- Iron as a Material of Construction : being the Substance of a Course of Lectures delivered at the Royal School of Naval Architecture, South Kensington. Revised and enlarged. William Pole, F.R.S. London. 8vo. \$2.50.
- Works of the United States, a Directory of—published by the American Iron and Steel Association. Philadelphia. 8vo.
- Light-House Establishments, European—(Official Report.) Maj. George H. Elliot. Washington. 8vo.
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- Mineralogy. Frank Rutley. Ed. by Sydney B. J. Sketchley. London. 8vo. 1s. 6d.
- , Papers on—from Proceedings of the Royal Academy of Sciences, Austria. V. Von Ritter Zepharovich. Vienna (German). 8vo. 3t.
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- Patents : Specifications and Drawings of Patents issued from the U. S. Patent Office for April, 1874. Washington. 8vo.
- Plants : Catalogue of—collected in 1871, '2 and '3. Washington. 8vo.
- Physics, Progress in—, 1872-3 (from the Quarterly Review of Sciences). Leipzig (German). 8vo. 3t.
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- Railroads of England in 1873. Report of M. Malezieux, Commissioner. Paris (French). 4to.
- Railway Engineering, Manual of—for the Field and the Office. 2d. ed., revised and enlarged. Charles P. Cotton. Dublin. 8vo. 7s. 6d.
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- Scientific London : an Account of the History and present Scope of the principal Scientific Societies and Institutions of London. Bernard H. Becker. London. 8vo. 5s.
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- Trigonometry, Plane—for the use of Colleges and Schools. With numerous Examples. 5th ed. I. Todhunter. London. 8vo. 5s.
- Ventilation, Health and Comfort in House Building; or, Ventilation with warm Air by self-acting Suction Power; with a review of the Mode of Calculating the Draught in Hot-air Flues, and with some actual Experiments. J. Drysdale, M.D., and J. W. Hayward, M.D. London. 8vo. \$3.00.
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## LIBRARY AND MUSEUM.

### ADDITIONS IN OCTOBER, 1874.

NOTE.—Members and others are asked to contribute regularly to the library of the Society, copies of government, municipal, railway, canal and other reports, specifications, profiles, maps, photographs and like matter, making up the record of engineering operations for the past or present, and to inform the Secretary where such may be had. Duplicate copies are desired, for transmission to foreign societies in return for works collected and sent to this library by them; also for exchange with members and others who wish complete sets referring to particular subjects. In order to gather material now considered of but little value, but of great future importance in the history of the public works of this country and a comparison of their economical results, donations are solicited of old reports or pamphlets, which in any way refer to their construction or operation.

### DONATIONS ARE ACKNOWLEDGED AS FOLLOWS:

From the American Iron and Steel Association:

The Iron Works of the United States—a Directory of Works, &c. Philadelphia. 1874.

From Thomas C. Clarke, Philadelphia, Pa.:

American Philosophical Society; Proceedings of—January, 1873, to June, 1874. 3 nos. Philadelphia.

Canadian Journal of Industry, Science and Art. 2 vols. Toronto. 1857-8-9.

Engineer (The). Vols. XXXI to XXXIV. London. 1871-2.

Geological Survey of Canada. Report of Progress for 1853-6, with Plans of Lakes and Rivers between Lake Huron and River Ottawa. 2 vols. Toronto. 1857.

Keystone Bridge Co. vs. Phoenix Iron Co. et al. In Equity. Argument. Circuit Court of the U. S. Eastern District of Penn. Philadelphia. 1871.

Railway Gauges—Construction, Machinery, Economy, &c. Letter from H. C. E. Childers, M. P. New York. 1872.

Reports, as follows:

Bale Verte Canal; Report of the Chief Engineer of Public Works on a Canal from Gulf of St. Lawrence and the Bay of Fundy. Ottawa. 1874.

Board of Public Works of Chicago for 1869, '71, '72 and '74. 5 nos. Chicago. Brooklyn Park Commissioners. 1870.

Brooklyn.

Canadian Pacific Railway. Report of Sandford Fleming, Chief Engineer, with Maps and Charts. 2 nos. Ottawa. 1874.

Chief of Engineers, U. S. A. for 1867, '8 and '9. 3 vols. Washington.

Crown Lands, Commissioners of—, Part II. Maps of Canada. Toronto. 1857.

Department of Marine and Fisheries—Sixth Annual Report. Ottawa. 1873.

Exploration of the Country between Lake Superior and the Red River Settlement, &c. S. J. Dawson. Toronto. 1859.

Fairmount Park; Fourth Annual Report of the Commissioners of Philadelphia. 1872.



- Inter-Colonial Railway. Addenda to Report. Ottawa. 1870.
- Montreal Northern Colonization Co. Report of Exploration from Deep River to the Georgian Bay. Charles Lagge, Chief Engineer. Montreal. 1874.
- Northwest Territory—Report on the Assinibonic and Saskatchewan exploring Expedition, by H. Y. Hind, in charge. Toronto. 1859.
- Rifle Association; Proceedings of the National—. London. 1873.
- The National—Annual Report. New York. 1874.
- From Maj. G. H. Elliot (also from Maj. P. V. Haynes, Engineer Secretary Light-House Board) Washington, D. C.:
- Report of a Tour of Inspection of European Light-Houses, made in 1873, by Maj. G. H. Elliot. Washington. 1874. 2 copies.
- From D. M. Greene, Albany, N. Y.:
- Annual Report of the State Engineer and Surveyor of New York, for 1873. Albany.
- From Gen. A. A. Humphreys, Chief of Engineers, Washington, D. C.:
- Catalogue of Plants, collected in 1871, '72 and '73. Washington. 1874.
- Design for an Improved Submarine Tunnel. Lieut. J. G. Foster. Washington. 1868.
- Geological Explorations of the Fortieth Parallel. Clarence King. Vol. III and V., with Atlas. Washington. 1870.
- From the Institution, Glasgow, Scotland:
- Transactions of the Institution of Engineers and Shipbuilders in Scotland. Vol. XVII. Glasgow. 1874.
- From T. Guilford Smith, Buffalo:
- Formal Opening of the Pittsburgh, Washington & Baltimore R. R., June 26th and 27th, 1871. Baltimore.
- Reports as follows, relating to:
- Baltimore & Ohio R. R. Co. 33d Annual Report. Baltimore. 1859.
- of Special Committee, to investigate its financial Condition. &c., presented April 14, 1858. Baltimore.
- Experiments on the compressive Power of Pine and Hemlock Timber, under direction of Maj. D. C. Houston, Corps of Engineers, U. S. A. Washington. 1872.
- Pennsylvania Railroad Co., the investigating Committee of—, Philadelphia. 1874.
- Schuylkill Navigation Co. Philadelphia. 1852.
- From E. & F. N. Spon. London and New York:
- Catalogue of scientific Books, principally relating to Engineering. 1874. (2 copies.)
- From Samuel H. Sweet, State Engineer, Albany, New York:
- Reports as follows, relating to:
- Canal; Chesapeake Bay and Potomac River Tide Water—from Washington to Annapolis. S. H. Sweet, Engineer. Albany. 1866.
- Commissioners of State of New York, Annual Report of—for 1871 and '74. Albany.
- Canals of New York, Annual Reports of the State Engineer on—for 1859, '62, '68, '69 and '73. 5 vols. Albany.
- Coal; Special Report on—. By the State Engineer. Albany. 1866.
- Hudson River; Removal of Obstructions from—. Albany. 1863.
- New York Harbor Encroachments; Report of Commissioner of Land Office on—. Albany. 1862.
- From *Unknown* Donor:
- Introduction to the Resources of Tennessee. J. B. Killebrew. Nashville. 1874.
- From Joseph M. Wilson, Phila., Pa.:
- Two Pieces of main Cable, Fairmount Suspension Bridge, (for experiment).
- From the Wisconsin Academy of Sciences, Arts and Letters:
- Transactions—Vol. II. 1873-4. Madison.
- From H. R. Worthington, New York:
- Duty of Pumping Engines.
- Duplex Pumping Engines at Jersey City Water Works; a framed Photograph.
- PURCHASED.
- Specifications and Drawings of Patents issued from the U. S. Patent Office for April, 1874. Washington.
- Uniform Trade List Annual for 1874. New York.

## ANNOUNCEMENTS.

**MEETINGS.**—The next *evening* meeting of the Society will be held Wednesday, November 18th, at 8 o'clock when a paper by H. Wadsworth Clarke, C. E., on the "Accident occasioned by an improperly constructed Truss, in Syracuse, N. Y., June 23d, 1874," will be read, and one by Caleb G. Forshey, C. E., on the "Levees of the Mississippi," will be discussed.

The next *stated* meeting of the Board of Directions will be held Monday, November 30th, at 2 o'clock, for the transaction of regular business.

The next *afternoon* meeting of the Society will be held Wednesday, December 2d, at 1

o'clock, when ballots for members will be canvassed, reports from the Committees on "Conventions of the Society, and on "Rapid Transit and the Handling of Freight in New York," called for, the Norman Medal formally presented, and other business transacted.

At the *evening* meeting of the Society, to be held December 16th, the paper by Prof. Robert H. Thurston, on "Efficiency of Furnaces burning wet Fuel," and at the one to be held January 20th, the paper by J. James R. Crocs, C. E., on the "Construction of a Stoue-Dam" (for which the Norman Medal was awarded), will be discussed. To facilitate discussions of these papers, advance copies will be sent, on request, to members who wish to take part.

# AMERICAN SOCIETY OF CIVIL ENGINEERS.

## PROCEEDINGS.

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### MINUTES OF MEETINGS.

(Abstract of such as may be of general interest to members.)

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#### OF THE SOCIETY.

NOVEMBER 18TH, 1874.—A stated meeting was held at 8 o'clock P. M. The reading and discussion of papers as announced was postponed, and Vice-President Roberts informally gave account of his late professional visit to Europe and Egypt.

DECEMBER 2D, 1874.—A regular meeting was held at 1½ o'clock P. M. The Committee to which was referred the Secretary's report on Annual Conventions\* made a report† by its Chairman, which was adopted, and the Committee discharged.

The Committee on "Rapid Transit and the Handling of Freight in and about New York," verbally reported by its Secretary that:—

By circular and the public press, engineers, inventors and others were invited to present plans for rapid transit, and in response a large number had been laid before the committee—some in complete detail as regards construction, location and estimate of cost.

A series of public meetings also were held to allow those interested in the subjects to be reported on, to confer with the committee; interviews were had with committees of several of the commercial and trade associations of this city, and with prominent merchants and others, to obtain views from their particular standpoint, particularly in reference to the receipt, handling and the storage of the various kinds of freight.

A large mass of valuable material, bearing upon the subjects to be considered has thus been collected—still in several respects it is incomplete, and efforts are continued to obtain what is yet needed. This and the preparation of the report (which is well under way), requires deliberate consideration.

The Committee expect to report at the next meeting of the Society or the one following—and ask for further time.

The report was accepted, the Committee continued and an extension of time granted.

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\* Page 133.

† Page 172.

## OF THE BOARD OF DIRECTION.

NOVEMBER 30TH, 1874.—A stated meeting was held at 2½ o'clock P. M.; applications for admission to the Society, and the investment of its funds were considered.

## MEMOIRS OF MEMBERS.

WHO DIED IN 1873-4,

APPENDED TO THE ANNUAL REPORT OF THE BOARD OF DIRECTION.

JOHN BENJAMIN ROGERS, C. E., was born in 1832, at Wellingboro Park, near the town of Wellingboro, England. After finishing his early education at a grammar school, he entered the Wolverton shops of the London & North Western R. R., and upon completing a four years' apprenticeship as a machinist he was sent to King's College, London, where after a two years' course of study he graduated with high honors.

He then was appointed the General Manager of the Köping Hult R. R., in Sweden, at that time in an unfinished condition, and, after completing it, remained in charge for some time, until his failing health necessitated a removal to a less severe climate. On resigning this charge he was elected to a Professorship in Queen's College, but finding that the sedentary life was unsuited to him he gave up the chair, and after a short time spent in England sailed for the Philippine Islands in 1863.

From this time until 1868 he was engaged in various engineering works in India and the Indian Archipelago. Among his most useful mechanical inventions were machines for cutting corks and the manufacture of ice, both of which are now in successful operation in this his late field of operations. He then returned to England, and in 1869 came to the United States, where he purchased a large cotton plantation near Manchester, S. C. Two years of cotton planting proved a failure, and his house having burned down, he removed to St. Louis, where he was at once elected the Chief Engineer of the St. Louis County R. R., and some time later, of the St. Louis & Great Southern R. R. In 1873, he was appointed one of the Commissioners on the part of the railroads entering St. Louis, to devise a means for adjusting their grades and that of the streets, so that they would not interfere, and while engaged in this work he was seized with his final illness—enlargement of the heart, consequent on a severe attack of jungle fever contracted in the East—and died April 1st, 1874.

He was a man of fine personal presence, of high social standing, and had conversational powers of a rare order. As a Civil Engineer, his success would have been marked had he lived to be better known in this country. His experience was large and varied and he knew how to apply it—while his mechanical and mathematical training had been

most thorough. His judgment was admirable and it was fully equaled by his readiness of resource.

He became a Member of the Society August 4th, 1873, and it is a matter of extreme regret to those engineers who knew him that he passed away so soon after, as he was a vigorous and ready writer; and there was much in his East India experience which, if published, would have been of interest to the profession.

COL. WILLIAM PHILLIPS, of Pittsburgh, Pa (admitted as Fellow, March 23d, 1870), was born July 12th, 1815, in the same ward in which he died April 14th, 1874.

At an early age, by the decease of his father, his mother became dependent upon him for support, and when 10 years old he began work on his own account. In 1832 he was apprenticed to the trade of a glass-blower, and not long after learning it he exhibited the active enterprise of his character by going into business for himself, with an available capital, as he often stated, of exactly "three fip-penny bits." He leased a site for his embryo works, and, assisted by an Irish laborer, made the excavations and built the furnaces. He was teaser, blower, helper and everything himself; meeting with success, he became ambitious, and by energy and perseverance soon made himself owner of these works, which he extended from time to time.

The fire of 1845 swept away the glass-works, and for the time it was thought he was ruined, but with his own hands he gathered up the debris, got out most of the melted glass, rebuilt his furnace, and was soon again comparatively more successful than before. He often said that this fire developed his character, and taught him to rely on his latent energy. In 1859 or 1860 the glass-works were burned down by an incendiary employee. The criminal was convicted of arson, and sentenced to the penitentiary. Col. Phillips pensioned the family, and in time secured the man's pardon and gave him work. In 1865, after the glass-works were again burned down and rebuilt, Col. Phillips relinquished his interest.

About this time he accepted the Presidency of the Alleghany Valley R. R., which then was in an almost hopeless condition, but under his management it soon approached speedy completion. He leased the Oil Creek R. R.; purchased the Buffalo, Corry & Pittsburgh R. R., and was building branch roads to serve as feeders for the main line. At one time he was also President of the Connellsville, now the Baltimore & Pittsburgh R. R.

He entered the City Council of Pittsburgh in 1850, and up to the time of his illness was an active, useful and judicious member of that body, and a friend to city improvement and progress. When the action of the volunteer companies threatened to deprive the city of protection against fire, he purchased some of the engines and had them manned until the Council determined on a paid fire department.

While in the glass business he became interested in a rolling-mill at

Kittanning, and at his death was a member of the firms of Lyon, Shorb & Co., and Phillips, Nimick & Co., largely engaged as manufacturers of iron. He was also prominently connected with various banks and insurance companies of Pittsburgh.

He was a man of fine social qualities, humorous, charitable, temperate and prudent in his walk through life. In business his judgment was excellent, and often deferred to. In the upright and manly discharge of his public and private duties he was excelled by no one in the State of his birth, whose immense and varied industries it was the chief aim and effort of his busy life to foster and promote.

JONATHAN CAMP, C. E., of Jersey City, N. J., admitted as Member December 31st., 1873, died April 16th, 1874. \*

JOHN MILTON BROWN, C. E., was born in Auburn, N. Y., February 14th, 1845. His early education was acquired in the public schools of his native town and at the Auburn Academy, where he prepared for college. He entered Hamilton College in 1862, and the next year went to Union, where he graduated in regular classical course in 1866, and as Civil Engineer in 1867, being in the last class graduated by Prof. Gillespie. Throughout his whole course Mr. Brown ranked high in scholarship, being known as a hard student; at the same time he was a general favorite with his companions by reason of his uniform kindness and gentlemanly demeanor.

He returned to Auburn and commenced the practice of his profession as Civil Engineer; he held the office of City Surveyor and Engineer one year and then took a position on the Southern Central R. R. He worked on the preliminary surveys, location and construction of this road over nearly its whole length from Lake Ontario to the Pennsylvania state line, passing through the regular grades of promotion until on the completion of the road he was acting Chief Engineer, in connection with which office he was subsequently appointed Auditor.

About this time he was tendered the Professorship of Civil Engineering in the University of Vermont, but he declined it, preferring to retain his position at home. He became a Member of the American Society of Civil Engineers April 7th, 1874, and up to May anticipated the pleasure and profit of attending the Annual Convention in June and extending his acquaintance among the members, but a severe cold contracted early in the spring, settled upon his lungs, and after a rapid decline he died of quick consumption June 16th, 1874.

For some time previous to his death he was a Vestryman of the parish of St. John's in Auburn, and the Superintendent of its Sunday School.

He had a just pride in his profession and a high sense of personal honor; he was wont to say that there were many things in this world worse than death—among these he counted dishonor. To a fine personal

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\* The Memoir of Mr. Camp will appear subsequently in Proceedings.

appearance, a bright intellect and sterling integrity, were added a warm heart and the rare faculty of winning the regards of others. By his death, just at the beginning of a career with brilliant prospects, the Society lost a useful Member, and the State a valuable citizen.

T. MARR JOHNSON, C. E., was born at Appleby, in Lincolnshire, England, June 29th, 1826. He was articled for four years to Mr. Dykes, Surveyor of Houghton, Yorkshire. After completing his articles he was engaged for two years on his own account, in surveying and other works connected with the fens of Lincolnshire. He then entered the office of Mr. John Fowler, Past President of the Institution of Civil Engineers (London), with whom he remained until the year 1870.

Mr. Johnson early developed both great professional ability and untiring energy, with considerable skill in design and the closest attention to details, so important to success in engineering matters; and he was therefore very shortly entrusted by Mr. Fowler with important works, including the Mid-Kent Railway, the Farnborough Extension of the West End and Crystal Palace Railway, and River Neul Drainage and Navigation, the Norfolk Estuary River, and Reclamation Works.

From 1865 to 1870 he was engaged with Mr. Fowler in carrying out the works of the Metropolitan, the Metropolitan District, and the St. John's Wood Underground Railways of London, involving some of the heaviest and most complicated engineering works of the present day. He also, in conjunction with Mr. William Mills, superintended the design and execution of the new Holborn Viaduct Station for the London, Chatham & Dover Railway Co.

In February, 1870, Mr. Johnson left Mr. Fowler, and joined the firm of Messrs. G. Smith & Co., builders and contractors; during his partnership, which continued up to the time of his death, this firm executed several large works—amongst others the new Town Hall at Manchester, and Eaton Hall, the residence of the Duke of Westminster.

He at one period spent several months in the United States, during which time he occupied himself in careful examination of engineering works there; and he always spoke with much interest of the experience thus gained.

Mr. Johnson was elected an Associate of the Institution of Civil Engineers in 1852, and transferred to the rank of Member in 1863; he became Member of the American Society of Civil Engineers February 26th, 1872, and died July 31st, 1874, at the early age of 48 years.

ISAAC CRAIG BUCKHOUT, C. E., was born in 1831, on the old Gouverneur Morris estate, of which his father was then manager; he became a Member of the Society July 15th, 1872, and died September 27th, 1874.

During his boyhood he showed great love for study, and at an early age chose the profession of Civil Engineer. In 1848 he was employed on the Harlem R. R. as rodman, under Allan Campbell, C. E., who was



afterwards President of the road. Later he was engaged in surveying in Paterson, N. J., under the direction of Col. J. W. Allen, and then became Engineer and Superintendent of the water-works of that city. Returning to New York, he practised as City Surveyor; he then resumed his connection with the Harlem R. R. Co., and in 1853 constructed the old viaduct over the Harlem flats, and the bridge over the Harlem river in 1853. In 1857 he became Engineer, and in 1863 Superintendent of this company.

He designed the "Grand Central Depot," but his greatest work is the "Fourth Avenue Improvement." When the charter for that work was granted, the Legislature appointed a board of four engineers, of whom Mr. Buckhout was one; and he was put in charge of the work. He prepared the plans for an underground railroad from the Grand Central Depot to the City Hall, and afterwards for a similar road in Brooklyn.

Mr. Buckhout was in charge of the improvement of the N. Y. Central & Hudson River R. R. at Sixtieth street. Here, by standing for hours on marshy ground, he was exposed to damp, and contracted malarial fever. He tried the restorative effects of rest and fresh air, but constant exposure and fatigue had done their work. His constitution was undermined, and he returned home with an acute attack of inflammatory rheumatism and pneumonia; this ran into typhoid fever, from which he died.

Mr. Buckhout was kind and affectionate; he possessed a quiet demeanor and made many warm personal friends. As an engineer, he was a man of great practical ability, skillful, indefatigable and careful in all details, and his advice was often sought by others in the profession.

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REPORT OF THE

## COMMITTEE ON ANNUAL CONVENTIONS.

ADOPTED DECEMBER 2D, 1874.

The Committee appointed September 2d, last, to which was referred the Secretary's report on Annual Convention,\* after due consideration, recommends, in acceptance of the views therein set forth, the following for adoption.

I. The President, Secretary, Chairman of the Finance and of the Library Committee, and three members appointed by the President, and residing where the Convention is to be held, shall constitute a Standing Committee on Convention, charged with their management, excepting as to such matters as now belong to the Finance and Library Committees.

II. The Convention shall begin on Tuesday, and continue for three days; sessions for the consideration of professional subjects shall be held from 9½ o'clock A. M. to 1½ o'clock P. M., each day, and one for the transaction of such regular business as may be then brought up, at 7½ o'clock P. M. on Tuesday; the Convention dinner shall be at 7½ P. M. on Wednesday, and the remaining available time devoted to semi-professional excursions and meetings for social intercourse.

III. Papers for the Convention may be announced by title, but none requiring more than ten minutes' time shall be read. The Library Committee shall select topics to be considered, from papers of the Society

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\* Page 133.



printed during the preceding year; for the discussion of each, two persons shall be chosen by that Committee, and three by the writer of the paper; after these, any member present may take part, and the writer close the debate; each person shall be limited to ten minutes' time, except by unanimous consent, and no one shall speak twice on the

same subject until all who desire to do so have spoken once.

IV. A full and complete order of proceedings shall be published in Transactions, at least one month before the Convention.

Respectfully submitted,

G. LEVERICH,  
Chairman.

## THE DINNER

OF THE TWENTY-SECOND ANNUAL MEETING

Of the Society was held at Delmonico's, at 7 o'clock P. M., Wednesday, Nov. 4, 1874.

Col. Julius W. Adams, President, was in the Chair. At his right was Gen. Theodore G. Ellis, Vice-President, and at his left Mr. Alfred W. Craven, Past President. Nearly 60 members and invited guests were present. The Presidents and Secretaries of the American Institute of Architects, of the American Institute of Mining Engineers, and of the Society of Engineers and Associates, the Honorary Members of the Society, the donor of the Norman Medal Fund. President F. A. P. Barnard, member of the Board of Censors and the attendant non-resident members of the Society, were invited as guests of the resident membership. After the cloth was removed:

Mr. JOHN BOGART (Chairman of the Committee of Arrangements) said: It has been made my duty to welcome our guests and to introduce the toasts of the evening. We, as resident members of this Society, feeling that our non-resident friends should enjoy, as far as possible, every advantage which the association may confer, a feeling that has been decidedly expressed in the management of the past year and in the promise for the future, extend to them at this time a fraternal welcome. To those here present representing our sister societies, seeking each in its own way the same high end as ours, the elevation of professional standards, the dissemination of experimental knowledge, and the increase of social feeling among men of practical sciences, I have, in behalf of this Society, also to extend a hearty greeting and the right hand of fellowship.

Col. JULIUS W. ADAMS, PRESIDENT, responded to the first regular toast: "The Civil Engineer."

I cannot better introduce the remarks I have to make than by quoting from an edi-

torial in the *New York World*, October 14th last, which it will be noticed was written during the Annual Convention of the American Institute of Architects in this city:

"There are two Conventions in session in New York to-day which ought to produce better results than we fear they are likely to. One is of the American Institute of Architects, and the other is of the American Society of Civil Engineers."\*

Various questions of more or less public interest are under discussion by both of these bodies, but there is a preliminary question which is of very high importance that does not seem to have been discussed at all. It is, what is an architect, and what is an engineer? To bodies like these we must look for the erection of standards which shall decide this question. \* \* The first interest and duty of a competent practitioner in any profession is to say that incompetent persons are, as far as possible, prevented from practicing it. We are sadly told that there is no law to prevent anybody from calling himself an architect or an engineer and deluding people more ignorant than himself into the belief that he is one. There surely ought to be such a law, which shall provide that no one who has not received a professional education and passed a professional examination shall be entitled to practice a profession. Shysters there are in law, and quacks in physic, but the law recognizes the necessity of protecting the public against them. It ought to protect the public also against quacks in architecture and engineering, whose malpractice is often as fatal, and even more costly, than the malpractice of either physicians and lawyers. It is to these Institutes, which presumably contain the select of both of these professions, that we have a right to look for the passage of such a law, and in the meantime for the erection of professional bars to supply, as far as possible, its absence."

It is unnecessary to expend many words in attempting to define the line of demarkation between these two professions, and yet it has been questioned whether such line really exists. Generally the engineer has but few doubts as to the boundaries of his art. He thinks, truly, that the whole science of con-

\* Referring erroneously to the meetings of the Committee on "Rapid Transit."

struction is the legitimate field. The architect, on the other hand, is daily called upon in his practice to apply methods and means, not only based upon the same principles which control the engineer in his constructions, but the same materials and worked into the same forms as are employed by the latter. There are, possibly, architects in practice who are in ignorance of the precise limits of their art, and are scarcely aware that there is any question as to when or where they may have been indebted for success or failure in results to a greater or less intimate acquaintance with principles outside of the legitimate field of their art. They do practice as engineers, and if they fail of success in this branch of their practice at times, it is but the consequence of the well recognized fact that the love of art—without which, indeed, no architect can hope to achieve greatness in his profession—is scarcely compatible with the attainments requisite for equal success in the severer paths of science.

But it must be confessed that their failures are neither so frequent nor so glaring as would be the case were engineers to attempt the practice of architecture. I would not be understood by this term architecture to mean *house-building* merely, but the design and construction of a true work of art. And here allow me to state that in this brief exposition of principles, if I appear to give, by comparison, the first rank to our own profession, it by no means arises from an under-valuing of the importance of the other, nor of the commanding position which we are ready to accord to the true architectural artist.

Engineering, we may say, consists in the adaptation of the powers of nature, whether active or passive, to a practical, useful purpose, whilst architecture consists in ornamental or ornamented construction. The one is an appeal to the sense of fitness for the practical end in view, the other to the æsthetic sense or beauty as an end. As opposed to the correctness of this latter definition, it may at once be said that in buildings for domestic or public uses one of the ends in view is practical, the commodious, convenient arrangement of the space covered, and the permanence and stability of the structure, and not mere beauty of outline and detail. This is true, but the design—all that constitutes it a work of art—the architecture, in short—is to be judged of solely by the canons of the art and such principles of taste as the critic may be enabled to bring to his aid; the remaining elements of fitness belong to the requirements of *building*—or, as we should say, engineering.

If the claim of architecture to rank as a fine art be allowed (and all writers on art, not purely technical, take that view), then building and architecture are totally distinct; the former is mechanical, industrial, dependent wholly on physical laws of construction; the latter, intellectual, refined, depending on the laws of taste. The one is a matter of bricks and mortar, pressure and strain; the other, of grace, harmony and proportion.

Architecture, then, is itself, like all fine arts, the creation of the higher part of man's nature, and subject to the intellectual and moral workings of individuals, nations and ages. It is true that it does not hold in public estimation the position which is so justly allowed to its sister arts of painting and sculpture, which are recognized as matters of taste and intellect, for it is unfortunately seen through an atmosphere of materials, estimates and contracts, and in the demand for card-board palaces and sham cathedrals in our rapidly growing cities the merits of a true artist, or his claims for the recognition of his art as a fine art, are not likely to command the attention which they deserve, until the public itself is better educated.

In common with the rest of the public, we are interested in this consummation, but not as workers. We trust that the American Institute of Architects will not fall short of the duties of its high calling, not the least of which is leading the public mind into such a channel of thought that the architect's subsequent labors will prove but the embodying of the national ideas into tangible shape.

In the meantime, our own works are more prosaic, and that it may be intelligently performed I beg leave to remind you very briefly of the beginning and early growth of our profession.

[The PRESIDENT then sketched the progress of building from the earliest ages, showing its necessary connection with and subordination to architectural art until the date of the revival of literature in Italy, in the fifteenth century, and the causes which subsequently led to the separation of architecture from civil engineering, and stated, as a remarkable coincidence, that from the day when the engineer took rank as a member of a distinct profession—no longer a mere adjunct to the architect—architecture has degenerated into an imitative art, capable of great results notwithstanding, but, as an art, imitative purely, and its professors occupy a comparatively subordinate position where once they were supreme.]

The PRESIDENT continued:—But what shall we say of the engineer? The revival of letters

was his birthday—no longer a mere subordinate, nor limited in his researches to the methods which sufficed for his earlier works, the work then pressed upon him by the progressive spirit of the times, required that he should master the principles upon which every branch of natural philosophy then known, depended. The demands of increasing population, actuated by a new spirit of enterprise, and vitalized by the power of the press and freer institutions, now called for increased facilities for production, only to be met by discovery and invention in the physical sciences following each other with (until then) unheard of rapidity—culminating at length in that crowning improvement of the age, the adaptation of steam to purposes of locomotion on sea and land. Since that consummation the demands upon the skill of the engineer have been so incessant, that nothing short of exhaustless resources could have met them. To give the merest sketch, doing justice to all the professional duties of the Civil Engineer in modern times, would be a labor far transcending my abilities or the measure of your patience.

Remembering that the steam-engine, that grand lever for the movement of the world, has received its great development in the adaptation to every useful purpose of man, since the days of Telford, I can do no better than repeat his oft-quoted definition of Civil Engineering, which you will find in the preamble to the Charter of Incorporation (in 1828), of the English Institution of Civil Engineers:

"Civil Engineering being the art of directing the great sources of power in nature for the use and convenience of man, in the means of production and of traffic in states, both for external and internal trade, as applied to the construction of roads, bridges, aqueducts, canals, river navigation and docks, for internal intercourse and exchanges, and in the construction of ports, harbors and light-houses, and in the art of navigation by artificial power, for the purpose of commerce, and the construction and adaptation of machinery, and in the drainage of cities and towns."

It will be perceived that the works which come under the denomination of engineering are sufficiently comprehensive and defined in the above. But Ferguson, a prominent architectural writer, who denies to modern architecture anything more advanced than a mere art of imitation, thus defines both the art of building and of architecture: "The art of the Civil Engineer consists in selecting the best and most appropriate materials for the object he has in view, and using these in the most scientific manner, so as to insure an economical but satisfactory result. Where the engineer leaves off, the art of the architect begins. His object is to arrange the materials of the engineer, not so much with regard to economical as to

artistic effects, and by light and shade and outline, to produce a form that in itself shall be permanently beautiful. He then adds ornament which by its meaning increases the effect of the disposition he has just made, and by its elegance throws a charm over the whole composition." He goes on to say: "Viewed in this light, it is evident that there are no objects that are usually delegated to the Civil Engineer, which may not be brought within the province of the architect. A bridge, an aqueduct, the embankment of a lake, or the pier of a harbor, are all as legitimate subjects for architectural ornament as a temple or a palace. They were all so treated by the Romans and in the middle ages, and are so treated up to the present day in the remote parts of India, and wherever true art prevails. It is not necessary that the engineer should know anything of architecture, though it is certainly desirable he should do so; but on the other hand, it is indispensably necessary that the architect should understand construction. Without that knowledge he cannot design; but it would be well if in most instances he could delegate the mechanical part of his task to the engineer, and so restrict himself entirely to the artistic arrangement and the ornamentation of his design. This division of labor is essential to success, and was always practiced when art was a reality; and no great work should be undertaken without the union of the two. Perfect artistic and mechanical skill can hardly be found combined in one person, but it is only by their joint assistance that a great work of architecture can be produced. A building may be said to be an object of architectural art in the proportion in which the artistic or ornamental purposes are allowed to prevail over the mechanical; and an object of engineering skill, where the utilitarian exigencies of the design are allowed to supersede the artistic. But it is nowhere possible to draw the line sharply between the two, nor is it desirable to do so. Architecture can never descend too low, nor need it ever be afraid of ornamenting too mean objects; while on the other hand good engineering is absolutely indispensable to a satisfactory architectural effect of any class. The one is the prose, the other the poetry of the art of building."

This view of the subject from the architectural stand-point, sustains the correctness of our original definition of the two arts. But, however desirable it may be to separate the practice of the two as thus suggested, and to regard the architect as an artist merely and not as a constructor, it is clearly not practicable to the extent there proposed. Long custom has established the system as we now find it, of holding the architect responsible for the building as well as the design, of all edifices intended for domestic uses, or public purposes, aside from those known as works of internal improvement. He is the engineer for the construction of such buildings, from the foundation stone to the topmost pinnacle, embracing the superintendence of all machinery, whether for lighting, warming, ventilating or hoisting, needed for the efficient use of the building for the purpose for which he has designed it. In addition to this, and

the design of the building, he is equally responsible for everything connected with its ornamentation or decoration; all that constitutes it, in short, a work of art. If he sees fit to call in the services of an engineer or a sculptor, he can divide the responsibility to just that extent and no further. We have seen what class of works it is the province of the engineer to design. If he has a bridge in hand, or railroad depot or tunnel entrance, or any work wherein he thinks it desirable that an appeal be made to the sense of the beautiful, as well as adaptation to the end in view, he will do well (as art is not his province) to call in the services of an architect—relieving himself of responsibility to just that extent, precisely as the architect might do in the case we have noted.

It thus appears, that it is neither possible nor expedient to attempt to separate the two arts entirely. The only separation which is attainable, is in the classification of the structures which constitute the field of practice of the respective arts. We have seen what these are. Wherever ornament, whether of outline or of detail, or the principles of taste are called into exercise in the design of a structure, the design comes under the head of architecture. All else is the special province of the engineer. Ferguson characterizes one as the poetry, the other as the prose of the art of building.

Charlatans and quacks abound in all professions; the remedy is similar in each—and we may hope, that when the American Institute of Architects, and our own Society of Civil Engineers, working in entire harmony, shall have acquired the prestige, which the importance of the work before them, and their earnest endeavors to do it justice, lead them to believe is attainable—there need be no longer question as to who is qualified to practice either—as an architect or an engineer.

Gen. THEODORE G. ELLIS, VICE-PRESIDENT, responded to the second regular toast, "American Engineering."

American engineering is yet in its infancy; while the state of the profession in this country is not as advanced as in Europe, at the same time we have many works of which, as engineers, we need not be ashamed. American engineering is distinguished by its grandeur and largeness of conception. In early days of this country works were executed, which, even at this later time, are marked. Two bridges may be instanced, which then were the longest in one span in the world, and that peculiarity is still maintained. The Niagara Suspension Bridge is the first example of a successful structure of this char-

acter, and the one now being erected over the East river exceeds in length of span any other. The first iron bridge was built, I think, somewhere in Pennsylvania. The Erie Canal, in the boldness of its conception, and its continued practical utility, is a fair instance of our engineering. I may also refer to our railroads, which are most extensive and have been pushed forward with an unsurpassed rapidity. These examples suggest the difference between American and European engineering.

While in length and magnitude our canals and railroads are remarkable, the works of engineers abroad, if not so large, are more beautiful. Some of our early structures may be called ugly, but that is a matter to which we shall look for improvement under advice of our associates, the architects. It is also to be said that there are those claiming to be engineers, who build very inferior works. Recent examples of dams giving way and of bridges breaking down disgrace the country and profession. But, as a rule, engineers have had very little to do with these. The Williamsburg dam, which I and other members of the committee appointed by the Society examined, was built without an engineer.

Shortly after this dam gave way, another in Connecticut was thought to be in a dangerous condition. Early one morning the whole population of the town located in the valley near by, in great haste left their beds for the hillsides, under the fear that the dam was breaking. The flood did not come, and the sensation created may be imagined, when, in cooler moments, these people, forgetting the fancied danger, began to look at each other.

The American engineer has a grand future before him. With our great rivers, peerless harbors and extensive country, there is need for large and remarkable works. Our river and harbor improvements must in time surpass any that the world has ever seen, and, beyond all, under the pressure of the necessity, we shall probably develop within the profession men of superior genius. To us is given a greater variety of experience than to those in Europe, and therefore a greater degree of originality may be looked for here than elsewhere. With the opportunities for so much practice, the art should develop highest and best in this country.

Mr. HORATIO ALLEN, PAST-PRESIDENT, responded to the third regular toast, "Our Railroads, and the first American Locomotive."

My recollections connected with railroads in this country can hardly be of interest to the Society, although my attention was early

directed to the railway movement. I was as well acquainted with George Stevenson as a young man can be with his senior, and saw him make experiments which it would surprise you to hear of. I also knew his son Robert.

Two things are put together in this toast which were not always connected; strange as it may seem to many, there was a time when the locomotive was not a necessity to the railroad, and it is not long ago when how to operate railroads was a debated question on both sides of the water. In 1828 this had not been settled, and it devolved upon me to determine for what power a certain road—the South Carolina R. R.—was to be built. Walker, of London, had been called upon to report what power should be used on the London & Manchester R. R., and after an extensive examination he advised that it should be worked by long ropes and a series of engines 1½ miles apart. On this side, similar advice had been sought for by the Baltimore & Ohio R. R., and it was determined to build it for horsepower. After considering such information as I had been able to gather, I reported in favor of locomotive power, taking the broad ground that there was no good reason to expect the breed of horses would be improved, while no man living could tell to what the breed of locomotives would come. The Board of Direction decided unanimously to build the road for locomotives; and that decision, first made on this side of the Atlantic, anticipated the Liverpool and Manchester R. R. report about a year.

So completely was the locomotive then not a part of the railroad, that on this road, when the owners inquired by what power it should be operated, it was recommended to use an engine that would draw three times its weight ten miles per hour, and this specification brought into existence the "Novelty" and other results of mechanical skill of that time. Perhaps I look back with undue satisfaction at having been the first American engineer to take this up, and unite the locomotive and the railroad so intimately that they hereafter must live and die together; but some of the most interesting passages of my life are connected with these early remembrances.

At that time, when in England, I met Timothy Thocko, a man not so well known as Stevenson, rough, uneducated, but of fine strong sense and superior sagacity; who, if he did not put the first breath in the locomotive, gave it a long draught. His device—the blast-pipe—attached to the tubular boiler of Stevenson's engine, gave us the working locomotive.

I saw that the four-wheeled locomotive was an imperfect machine which must have more power distributed over the track, and this led me very early to propose the building of the eight-wheeled locomotives. In South Carolina at that day were two English engineers who thought nothing could be well done except it was first done in England. They considered it preposterous for an American to talk of an eight-wheeler, but I kept on and finally succeeded in building the first one. Considerations of economy aided me, in that I tried to save by making the body of the locomotive carry the whole structure. I built the boiler with a central fire and flues on both sides, which was a nice, but you will not say, a very judicious arrangement. I was obliged to use pitch pine wood as fuel, which speedily choked my flues, and caused me many an anxious hour. If my flues had been of proper diameter—or I had known of Thocko's blast-pipe, the boiler could have been a successful steam-making machine. I asserted that eight and ten-wheel locomotives would be the life of the road, and I was right—since then we have them, and how many more wheels will be attached I am unable to say.

In conclusion, permit me to say to young engineers, carefully record and keep all your ideas and plans; in forty years you will be glad to review the recollections of your early failures and successes.

Mr. THOMAS F. ROWLAND—We have on several occasions been entertained with historical reminiscences by our venerable member, Mr. Allen. It is proper for the Society, and I make this motion, that he be requested to prepare a paper embodying his recollections of the early history of railroads, and the adoption of the locomotive in this country, for publication in the "Transactions."

The motion was carried by acclamation.

Mr. ALLEN—There is much in the history of the introduction of railroads in this country, and the use of steam-power on them—which was first done here—that is interesting. Not only did America not import its railroads, but it aided so largely in their development that, on the other side, much benefit has been derived from the experience here; and this history should be put on record.

Several times I have been asked to prepare a paper relating to whatever connection I had with this work, but it seemed too much a personal matter, and, on the other hand, it would require much valuable time; called upon as I have been on this occasion, I can but promise to give the request due consideration, and, if I can put the account in such



shape as to be of interest to the country and a credit to our profession, 'I shall feel it my bounden duty to do so, especially as now I may venture upon the undertaking more gracefully than before.

HON. WILLIAM J. McALPINE, PAST PRESIDENT, responded to the fourth regular toast, "Our Canals."

Canals are imitations of Nature's navigable water-courses, and in their relations to commerce the two must be considered together. The continents are alike, in each having a central plateau of considerable elevation, from which the great rivers radiate to the surrounding oceans. Most of these rivers have been navigated from historic times, and with the inland seas have marked the seat of empires, and determined the lines of the flow of migrating and conquering nations.

Herbert Spencer, who was an engineer before he was recognized as philosopher, says: "The earliest recorded civilization grew up in hot and dry regions, and from within these or on their borders came all the conquering nations of the world." Great water-courses marked the line of early conquest in the old world, nor was America an exception to Spencer's statement, that "the dry and nearly rainless districts of Mexico and Peru were the centres of civilization."

The right arm of great men in all time has been an engineer; his skill was combined with the greatest military and administrative talents in the early history of Greece, Rome, Russia and younger nations.

The progress of canal navigation and its engineering can be readily traced from the rudest conditions of life. For man, as a hunter, the pathway of the various animals was sufficient. He could paddle a floating log across a river, or use a dug-out tree, and for greater distances or burdens construct a raft; on this to place a floor made watertight was but a step, or, instead of a canoe, hides sewed together stretched over boughs of trees or slender ribs, and pitched—perhaps were the first boats; such were employed in the grain traffic between Britain and the continent. The paper boats of the Nile were followed by those shoaled with strips of thorn, but long before this the ships of Tyre were built of planks of the "cedar of Lebanon." The Phoenicians and Arabians built vessels strong enough to withstand the tempests of the ocean, and from these came the great navies of the succeeding nations.

The skillful artists and redundant population of South Eastern Asia supplied gold, silks and spices to the prospering western nations, and nature seemed to have adapted its products to meet the demands of trade,

The configuration of the earth and its resultant suggested the first and only great oceanic canal. Sesostris opened a water line to the Red Sea and the Nile, with which no engineering work in history compares in importance, or in results upon commerce and civilization. There is no historical account of canals for navigation during these times, though for irrigation they were abundant; however, it is faintly hinted that the latter were used to float corn to market. The Romans of the later empire used the rivers of Gaul to transport materials of war and food for their armies, and cut many canals so that the land portages to the Bay of Biscay, and the German and Baltic Oceans, were very short.

For many centuries the ingenuity of man had been unable to conduct canals over elevations by other than flushed sluices—inclined planes—in imitation of natural water-courses. In the fourteenth century a master-mind, such as appears in almost every age, a man eminent as an artist, but not so well known as an engineer, Leonardo da Vinci, was the first to use the modern double gate canal lock; and the real inventor preceded him only about two years.

The first illumination after the dark ages was by the North Italian engineers, who, for two hundred years, constructed their own canals and those of France, connecting the old Roman portages and the kingdom of Charlemagne with water-lines of transportation, which to-day are sources of wealth.

Later, in England, James Brindley built the Duke of Bridgewater's canal, and Telford, the father of English engineering, followed this with locks, gates and aqueducts of iron; thus antedating what the younger members of this Society will see accomplished.

Our own country has been the best exponent of this old-time system. The great chain of lakes approaches so near the ocean on the northern boundary of this State, that an artificial canal was necessary to avoid the cold, inhospitable debouching of the St. Lawrence, and the seventh wonder of the world—the Erie Canal—was built.

The idea of connecting the fertile West with its Atlantic market, was seized by Pennsylvania and Virginia, and their canal systems followed. Overwhelming corporate influence destroyed the former, and apathy the latter—neither has proved a commercial success. Ohio, Indiana and Illinois each built extensive canals to connect the navigable waters of the Ohio and Mississippi with the successful outlet from the Lakes to the port of New

York. The infancy of a new and sparsely settled country rendered these canals premature, and they have all gone into decay, except that great one connecting Lake Michigan with the Mississippi. But some of these water-lines through Pennsylvania and Virginia, and next through Ohio and Indiana, are soon to be re-established.

The inauguration of railways produced such wonderful changes that the unreflecting mind of the public was easily aroused to enthusiasm, and persuaded that the days of canals were ended; that such were to be filled up and a new mode of conveyance to supersede them. A more extended examination of the matter will show the error of this opinion. Each of these systems has appropriate functions to perform. The necessities of the age require quick transit of news and people; the telegraph answers the demands of one, and the railways of the other. No human skill can supersede the immutable laws of Nature; a costly transportation of the products of the seasons will not mature their benefits, time will not compensate for the extra cost of carriage, nor will men tolerate "the skeleton of the corn crib."

To-day the mission of engineers is not merely to develop the present system of transport by railway, they are called upon to provide canals and similar water-lines for the movement of freight and produce; in their hands, at no distant time, canals will be a "renaissance."

Mr. EMLEN T. LITTELL, Acting-President of the New York Chapter of the American Institute of Architects, responded to the last regular toast, "Our Kindred Societies."

We architects had thought that we were rather a kind of mother-in-law, whom the engineers had left, and very wisely. We did our part in the middle ages and up to the time of the separation between engineering and architecture. I feel interested, as far as I represent the Institute, in the sentiments and opinions that have been here expressed in regard to the dividing line between the professions we represent, but I differ with Ferguson when he says that there are no living architects in this day; that was in his youth, not in his manhood. There are men now who are determined to raise the art to its highest rank, and who have the ability and education to do it. These men are working day by day, and every day sees more and more progress.

One great impediment to architects has been their ignorance of civil engineering. They, wrapt up in their art, have neglected to inquire when they might have learned of the engineer. A man whose bent of mind

inclines him to aesthetics, might know that naturally he would be deficient in scientific knowledge of engineering, and therefore should go to those who practice it for help.

On the other hand, it is equally true that the Civil Engineer has a certain responsibility in regard to architecture; in some respects he is the greater architect, in that he deals with Nature and her works. Thus, when an engineer builds a viaduct or canal across a valley, he puts himself in harmony or contrast with Nature, and every constructor may see in this his duty to seek to emulate her, by impressing beauty on his works of utility.

Mr. J. JAMES R. CROES, responded to the toast "The health of the first Norman Medalist."

I am much in the condition of a man who has received a blow that knocked him down and another that set him on his feet; the first came from the Board of Censors this morning, and the second from you, gentlemen, this evening, in calling thus upon me, an engineer, who is essentially a man of action, to reply to a toast.

It, however, is proper that something should be said on this occasion, the first award of the Norman Medal. Paraphrasing Longfellow—"Of the past the old men's thoughts are, but the young men's of the future." I represent the young men, and it is true that young men are interested in the future of American engineering, and they can manifest this in no better way than by imparting to each other, year by year, the experience gained on works on which they may be engaged.

With this view the paper that was so fortunate as to receive approval of the Board of Censors, was written. I endeavored to detail the history of an important work from inception to close, and state the cost of every item, not only in money but in time, and thus enable others in the profession to make estimates of the cost of similar work, superior to any from a contractor; varying under the same specification as their estimates did recently in this city—from \$330,000 to \$660,000. What basis is such for an engineer to estimate from? No one who has not had charge of a work can determine what is the cost of certain parts of it.

The responsibility of the work described should be placed where it belongs; there are two Members of this Society, long associated together on the public works of this city, by whose kind favor I was placed in a position to be able to give these data, one a Past-President—the projector of the dam described, and the other its designer—to-day



made a member of the Board of Direction, the first aptly representing the "suaviter in modo," the other the "fortiter in re," and to them is due whatever honor and praise may be accorded.\*

PRESIDENT ADAMS—As Chairman of the Board of Censors, which awarded the Norman medal, I may say that Mr. Croes' paper is admirable as showing the scope of examination needed on public works. It deals with the practical facts which relate to a structure, and not with mere theories.

Mr. BOGART announced that the list of regular toasts was closed, and called on the author of a little work which has given much comfort and aid to engineers—

Mr. CHARLES H. HASWELL, who said: This matter of public speaking is like writing poetry—a man must be born to it. I do not possess the gift, but claiming to be the oldest practicing mechanical engineer in New York to-day, I will run an excursion train through some reminiscences of my profession.

I built a steam-engine in 1824, when John Roach, Theodore Secor and others of our manufacturers were apprentice boys. At the time I went into the shop, we cut a boiler sheet in two and riveted it together to make it stronger, and straps and ends were finished in the smith-shop.

In 1839, when I was in the Navy, and we decided to introduce wrought-iron shafts into the steam frigates "Missouri" and "Mississippi," then being designed, we went to England for a trip-hammer and a man to operate it. In a short time after it was received American ingenuity had set aside every individual part of that instrument except the cubical hammer-block; and a boy apprentice in the West Point Foundry, Mr. Tugnot, of this city, where the hammer was in operation, superseded the English operator and took charge of the work.

Up to the year 1823, when the steam ferry-boat "Hoboken" was built all of our river steam-engines were of the vertical cross-head type; the cross-head, connecting-rods, cranks, centre and water-wheel shafts being of cast-iron, and I have known on more than one occasion, in consequence of the cross-head breaking, that there was a general breakdown, cast-iron being very indiscriminately distributed about the engine room, and in five days the boat was running again, owing to the facility with which a cross-head, connecting-rods, &c., could be cast, and with the rough fitting then in practice, rapidly connected.

With regard to compound engines about which we are now very much exercised,

they were first invented in England by Wolfe, and subsequently reproduced by Hornblower; the only difference between those now constructed and then is, that now they are operated by steam of a much higher pressure, and have an inter-expansion chamber between the cylinders. In 1825 James P. Allaire, (whose establishment I entered in 1828,) constructed the engine of the "Henry Eckford," the first practical application and introduction of the compound engine in this country or England; he subsequently constructed like engines for the "Post Boy," "Commerce," "Swiftsure," "Sun" and "Pilot Boy," and the "Sun" was the first steamboat that ever made the passage from this to Albany between "sun and sun," which was in 12 hours and 18 minutes. The compound engine of this day is the compound engine of Mr. Allaire, with the single exception in construction of the inter-chamber, and the difference in practice of operating it with steam of a higher pressure.

I have recently investigated and collected the elements of a history of steam boilers, and am now engaged in preparing the work for publication. The history in our books gives Trevithick and Vivian of England, the credit of inventing high pressure engines in advance of Oliver Evans in this country, but I can show that the latter operated and patented the high-pressure steam-engine a year before the others. I have the English record in support of this. Thus, Evans invented the non-condensing engine, and applied for a patent for it in 1792. In 1802 he constructed an engine, and it was not until March 24th, 1803, that Trevithick obtained a patent for his engine.

I find also that the first practical tubular boiler, either fire or water tube, was invented and introduced in this country.

These are the salient points that occur to me at this time, in the train I proposed to run.

Gen. JOHN G. BARNARD responded to the toast "The Engineer Corps of the U. S. Army."

As an Honorary Member of this Society, I have to congratulate it on the great development of influence and reputation which the past few years have witnessed. Not long ago this association was struggling for existence; it now is a power justly felt more and more in the land, in all our engineering enterprises.

The last decade has witnessed enormous development in works of engineering. Fifty years ago the far-seeing and more intelligent of your predecessors sketched out great civil

improvements, but were hardly able to look forward to their realization; at the present day it is rapidly being accomplished. The great West is demanding that no longer shall mountain chains or mud bars prevent an easy communication with the sea-board. The improvement of the mouths of the Mississippi, opening as it does that vast region down to the Gulf, is now claiming the attention of our Government and of the United States Engineers; but by you, who are Civil Engineers, mainly must such works be accomplished. Referring to you, in a comment upon the report on the Williamsburg Dam, read at the late Annual Convention, a city daily paper justly said, "On these men our lives depend."

Our railways, which but recently timidly stemmed the banks of the great rivers, now boldly throw their iron tracks across, and works of enormous engineering magnitude are developed in consequence. The poet-engineer who wrote on bridges fifty years ago exclaimed,

"Let the broad arch the spacious Hudson stride,  
And span deep rivers far more wide."

The towers of the East River Bridge are able monuments of unrivaled magnitude and engineering difficulty, and soon will await the application of the inverted arch which the genius of Roebling enables us to realize! At St. Louis the Mississippi has been spanned by a bridge which compares favorably with any similar structure in the world. The project of connecting the Mississippi with the waters of the James River Canal, now sketched out by some of your ablest men, is not far from realization. And here may be mentioned the canal tunnel which—as designed, exceeds in length even that of Mont Cenis—is now being surveyed, and the results to be submitted to Congress.

How shall these great works be carried out, and that unity, harmony and safety in their execution be attained which it is the duty of the Civil Engineer to secure, except through the organization of this and similar societies? The late Mr. Rankine defined Civil Engineering "as the art and science by which the physical properties of matter are made subservient to the purposes of men." This definition is better than that adopted by the Institution of Civil Engineers (of England), "The means of diverting the sources of power in Nature to the uses of men," for it is more general and exact.

This subjection of the physical properties of matter to the purposes of man requires an intimate acquaintance with physical sciences, the study of which belong to the preliminary

education of engineers. Such, however, can be but the foundation to that more complete education which is derived from the examination of works which engineers all over the world are executing, and for which the organization of societies like this is an indispensable necessity. No engineer, however able, is competent to all things, and he cannot give, in reference to an unsolved problem, one not in a precise form and subject to ordinary rules, an authoritative opinion without a perfect acquaintance with what has been and is being done. It is to these ends that organizations like the American Society of Civil Engineers are addressed. They form the means of association, bring engineers together, and aid in comparison of results; and by publishing accounts of works which each may master quietly in his study enable members to teach each other. Thereby, also, libraries are collected which contain the record of the results of engineering effort and bring us in contact and union with those who project and carry them on. This, perhaps, is one of the things most essential to encourage progress in the engineering art.

The great problems which our immense country is now presenting to us demand, not only the ability of the executive engineer—for there are many who can carry out such works, if well planned—but that we shall be able to plan these works with credit on well-defined principles, without assumptions not verified by practice. For the theory of matter, so far as it concerns the engineer, is so difficult and complicated, and gives rise to so many opinions, that no rule can be safely followed which is not based on the study of what has actually been done.

The engineers of the United States Army have had from the beginning of our country's history a large part in the execution of these works. The education received at the military academy, the ready access to the reports and records of projects of other engineers all over the world, and the emulation and rivalry produced, has enabled them, so far as they have accomplished their work, to do it successfully. Some of the more prominent structures in the country have been executed under their direction. I could instance many. The Delaware Breakwater is one.

Our military works are in the very building mere examples of mechanical architecture, but they involve in preparation, very frequently, some of the higher problems in engineering. It is by the scientific knowledge and study of the principles upon which these are based, aided by an "*esprit du corps*" and energy in carrying out operations, that the

military engineers have gained whatever reputation they have as Civil Engineers

I will close, as I commenced, by congratulating you for having thus taken measures to greatly develop engineering, and enable the members of this association to communicate to each other their results, by publica-

tion of the "Transactions" of the Society, which certainly contain papers equal in ability to any in journals of foreign institutions. Permit me, therefore, to give as a toast, "The American Society of Civil Engineers."

To this the Secretary briefly responded, and the company separated.

#### NEW BOOKS ON

### ENGINEERING AND TECHNOLOGY.

- Algebra, descriptive and applied.—Part I of Manual of Civil Engineers. Paris (French). 12½ f.
- Ammunition, Treatise on.—London. 8vo. illus. \$3.00.
- Arches; a practical Treatise on Voussoir.—William K. Cain. New York. 18mo. \$0.50.
- Architecture for general Students. Caroline W. Horton. New York. 12mo. \$1.50.
- Artillery; Two Duels under the Forts of Paris. Gen. Favé. Paris (French). 2½ f.
- Experiments; Analysis of the Reports of Boards at Tarbes, Calais and Bourges. Mon. Dutemple. Paris (French). 1½ f.
- Tactics U. S. Army assimilated to the Tactics of Infantry and Cavalry. New York. 32mo. \$2.00.
- The Determination and Use of Tables of Fire. E. Jouffret. Nancy (French).
- Astronomy; Brinckley's—revised and partly rewritten, with additional Chapters by John W. Stubbs and Francis Brünow. London. 8vo. ill. 6s.
- ; Outlines of.—Arthur Searle. London. 16mo. \$2.00.
- Azimuths; Table of—for all Stars and Latitudes. Prof. A. Huc. Marseilles (French). 5f.
- Blowpipe; The—; a Guide to its Use in the Determination of Salts and Minerals. Compiled from various sources by George A. Plympton. New York. 12mo. \$1.50.
- Book List; a systematically arranged Catalogue of all mechanical, technological, architectural and engineering works published in Germany and other countries. 23d year. Part I. January to June, 1873. (German.)
- Bridges and Viaducts of Wood and Metal. Part XI of Manual for Civil Engineers. Paris (French). 30f.
- of Masonry. Part XII. of Manual for Civil Engineers. Paris (French). 25f.
- Military—; a Special Course on—and the Passage of Rivers. Paris (French). 2f.
- Treatise on the Construction of—with an Appendix on Tunnels. Mons. Morandiere. Paris (French). 40f.
- Building Law. Manual of.—Ed. by Central Society of Architects. Paris (French).
- Capillarity; Researches upon dynamical.—C. Decharme. Angiers (French).
- Cave Hunting. Researches on the Evidence of Caves, respecting the early inhabitants of Europe. W. Boyd Dawkins. London. 8vo. illus. 21s.
- Chemistry; Dictionary of Pure and Applied.—Ad. Morz. Paris (French).
- Coffee in Natal; its Culture and Preparation. H. E. Stainbank. Two parts. London. 12mo. illus. \$0.80.
- Commerce; Annual of—of Paris. K. Forvinier and A. Metz. Paris (French).
- Construction; Hand-book of—a Systematic Arrangement of the Results of the Science of—with all auxiliary schemes in their application to the planning and erecting of structures. Berlin (German). illus.
- Cyclopedia; American Annual.—Vol. XIII, for 1873. New York. 8vo. \$5.
- The American—a popular dictionary of general knowledge. Ed. by George Ripley and Charles A. Dana. Vol. VII. Evansham—Glascock; Vol. VIII. Glasgow—Hortense; Vol. IX. Hortensius—Kingleake. New York. 8vo. illus. Each \$5.
- Draughtsman's Hand-book of Plan and Map Drawing, including instructions for the preparation of engineering, architectural and mechanical drawings. George G. Andre. London. 4to. illus. \$6.00.
- Dwellings; Healthfulness of—a practical Manual on Heating and Ventilation. Gen. Morin. Paris (French). 7½ f.
- Earth and its Treasures; a description of the metallic and mineral wealth of nature. Arthur Mangin. Ed. and with additions by W. H. Davenport Adams. London. 12mo. 3s. 6d.
- Eclipses, past and future, with general hints for observing the heavens. S. J. Johnson, F.R.A.S. London. 12mo. \$2.00.
- Engineering, agricultural and rural.—2 Parts of Manual for Civil Engineers. Paris (French).
- Works; Superintendence and Construction of—Part IV of Manual for Civil Engineers. Paris (French). 30f.
- Engineers, Civil; Minutes of Proceedings of the Institution of—with abstracts of the Discussions. Vols. XXXVII, XXXVIII. London. 8vo.
- Royal; Papers on Subjects connected with the duties of the corps of—, Contributed by the officers. Vol. 22, new series. Woolwich. 8vo. illus. \$8.00.
- Society of—Transactions for 1872. London. 8vo.
- Freight Transportation; Hand-book of—of the German and Austrian-Hungarian R. R.'s. Berlin (German).
- Glass-houses on the Venetian Method, the Flemish Manufacture—from unpublished documents. J. Houday. Lisle (French).
- Geodesy and Leveling; Part V of Manual for Civil Engineers. Paris (French). 7½ f.
- Geology, a brief sketch of theoretical—W. M. Brookes. London. 8vo. 1s.

Liquors, Adulteration of—with a Description of the Poisons used in their Manufacture. Oliver Cotter. New York. 12mo. \$0.50.

Meteorological Observations made at Lisle in 1871-2. Victor Merwin. Lisle (French). Meteorology. Report of the Meteorological Committee of the Royal Society for 1873. London. 8vo. 4d.

Minerals, Tables for the Determination of—by their physical Properties. Trans. from the German of Weisbach. By Persifer Frazer, Jr. Philadelphia. 12mo. \$2.00.

Mines; Course pursued at the Paris School of—M. J. Callon. Paris (French).

—; Treatise on the Working of—M. J. Callon, Vol. II. Paris (French). 32½.

Mining Experiences, derived from the Reports and Transactions of the Austrian Mining Officials. Vienna (German).

Military Lessons. A Text-Book for Military Schools, Colleges and the Militia. Prof. W. T. Welcker. New York. 12mo. \$0.80.

—Section of the Vienna Exposition Mons. Derwen and Weil. Paris (French).

Nautical Almanac for 1876. Prof. C. Boenicke. Berlin (German).

Navigable Waters of France, Manual of—A. Larue, Ch. of Transport Science. Creuzot (French).

Navigation, Practice and Theory of—and Nautical Astronomy. W. Culley. Bergen. 3d. ed. 8vo. London. 16s.

Patents: Popular Treatise on the Patent Laws and their Working and Reform, for the Development of Art and Manufactures and the Protection of Inventors. John Brown. London. 8vo. 2s.

—: Description of Machinery and Processes patented under the Law of July 5th, 1844. Paris (French Government Report).

—: Specifications and Drawings of Patents issued from the U. S. Patent Office, for May, 1874. Washington. 8vo.

Phosphates of Commerce, their Composition and Chemistry. London. 12mo. 2s. 6d.

Physics: First Elements of Industrial—Prof. E. St. Edme. Briez (French).

—; the Elements of—Sidney A. Norton. New York. 12mo. \$1.12.

Presses, new system of Engine—J. Galdius. Paris (French). Illus.

Public Works—Part XIV of Manual for Civil Engineers. Paris.

—of Holland. M. Croizette. (German). 40f.

Railroading: Record of the technical Progress

of—The Organ of the Society of German R. R. Administration, 29th year. Weis Baden (German).

Railroads; being Part XIII of Manual for Civil Engineers. Paris (French).

—: Actual State of—Mons. Du Sin and Fousset. Paris (French).

—Legislation and Decisions on the Transport of Merchandise by—Rights and Duties of Shippers and Consignees. Responsibility of the Companies. Louis Surrat. Paris (French).

—of France; their Condition Dec. 31st, 1873. Paris (French Government Report).

—; Report on Economical—E. Clibries. Nancy (French).

—in War; and the Destruction of—Prague. (German.)

Railroad System; Organization of the Prussian—Ersen (German).

Roads; being Part IX of Manual for Civil Engineers. Paris (French). 15f.

Science; Treasury of—natural and physical. F. Schoedler and H. Medlock. New Ed. London. 8vo. 7s. 6d.

Scientific Instruction: Royal Commission on—and the Advancement of Science.

Minutes of Evidence, Appendices, and Analysis of Evidence. Vol. 2. Parliamentary Blue Book. London. \$3.50.

Sewage; the Truth about—in a few Words. Andrew Fenwick. London. 12mo. \$0.25.

Slide Valve; the Lightning Slide Valve Calculator. John A. Caldwell. Card 11 by 14. With descriptive Pamphlet. Philadelphia. \$3.00.

Ships; Unseaworthy—Final Report of the Commissioners on the Unseaworthiness of British Ships. With Evidence. London (Parliamentary Report). 12s. 6d.

Sugar; The Manufacture of Beet-Root—L. Gautier. Paris (French). 34f.

Telegraph; The Electric—Louis Honzeau. Paris (French). 3f.

Telegraphy; Military—by Signals. Capt. Pouget. Rochefort (French).

Tunnel: Submarine—between France and England. Emile Level. Paris (French).

Tunnels; Part XII of Manual for Civil Engineers. Paris (French). 10f.

Vienna Exposition; Report of the Citizens' Delegation to—Paris (French). 60f.

Water Supply, a Paper on—for Country Mansions. Read at the Royal Institute of British Architects, January 26th, 1874.

Richard B. Grantham. London. 4to. 2s.

#### ADDITIONS TO

### LIBRARY AND MUSEUM.

#### DONATIONS ARE ACKNOWLEDGED AS FOLLOWS :

From S. T. Abert, Washington, D. C. : Specifications for Improvement of Elizabeth River, also of Nansemond River, Va. 1 copy each.

From Bureau of Navigation, Washington, D. C. :

Logarithms of Sines and Cosines, with the Argument in Time. Washington, 1874.

From Dougherty & Brown, New York : The Renshaw Patent Sectional Boiler (Descriptive pamphlet).

From Civil Engineers' Club of the Northwest, Chicago, Ill. : Foundations; Paper No. 7, by William Bryson, C. E.

From the Director of the Institute. Annual Report of the Rensselaer Polytechnic Institute. 1873-4. Troy.

From F. Graff, Philadelphia, Pa. : Report on Duty and Capacity of the Worthington Duplex Pumping Engines, at Belmont.

From the Editors and Publishers, New York :  
The American Cyclopaedia. Vols. VII., VIII., and IX. From Eversham to Kinglake. New York, 1874.

From Maj. P. A. Hains, Engineer Sec'y Light-house Board, Washington, D. C. :  
Light-houses at Calcasieu, Cleveland, Race Rock, Spectacle Reef, Straits of Karquines and Thimble Shoal. 6 large photographs.

From Gen. A. A. Humphreys, Chief of Engineers, U. S. A. Washington, D. C. :  
Report on the compressive Strength, specific Gravity, and Ratio of Absorption of various kinds of American building Stones. Gen. Q. A. Gillmore. Washington, 1874.  
Report on the Irrigation of San Joaquin, Tulare and Sacramento Valley, Cal. Washington, 1874.

From the Institution of Civil Engineers, London, England :  
Minutes and Proceedings, with Abstracts of the Discussions. Vols. XXXVII, XXXVIII. London, 1874.  
The Fixed Signals of Railways, by R. C. Rapier. London, 1874 (5 copies).

From E. Malezieux, Paris :  
Railroads of England in 1873. Report of the Commissioner. Paris (French).

From W. J. McAlpine, Albany, N. Y. :  
Annual Financial Report of the Auditor of the Canal Department of New York, for 1870 and '73. 3 vols. Albany.

From W. T. Pelton, New York :  
Report on the Decay and Preservation of Timber. T. J. Cram, Corps of Engineers, U. S. A. Washington, 1871 (Copies for distribution).

Wooden Pavements, how to make Them durable and economical (Copies for distribution).

From E. Pontzen, Vienna, Austria :  
Austrian Northwestern R. R. Bridge across the Elbe River at Tetsihen (German).

From the Railway Association of America :  
Journal of the Association, No. 1. St. Louis, 1874 (4 copies).

From the Saxonian Institution of Architects and Engineers. Dresden :  
Proceedings of the 82d General Meeting (German). Dresden, 1874.

From Alfred F. Sears, Piura, Peru :  
Irrigacion—Represa del Rio Puiria. Informe presentado a la junta centrale de ingenieros. Por Alfredo F. Sears. Lima, 1874.  
Mencosia sobia Las Obras Publicas del Peru, Presentada al Gobierno la Republica, por La Junta Central del Cuerpo de Ingenieros y Arquitectos del Estado. Lima, 1874.

From the Society of Engineers, London :  
Transactions for 1872. London, 1874.

From Frank Thompson, Gen. Mang. Penn. Railroad, Philadelphia :  
Specifications for a perfect Sub-Division. G. C. Gardner.

From Union Iron Co. Buffalo, N. Y. :  
Book of Shapes. Buffalo, 1874.

From N. J. Welton, Waterbury, Conn. :  
Annual Report on Steam Boilers. T. H. Laforge. Waterbury, 1874.

From J. J. Williams, Jackson, Tenn. :  
Engineers' Report of the Jackson, Tennessee River, & Birmingham R. R. Jackson, 1873.

Improved Fish-Bar Joint for Rail Fastenings. Jackson, 1843 (Descriptive pamphlet and lithographs).

#### BY PURCHASE.

Specifications and Drawings of Patents issued from the U. S. Patent Office, for May, 1874. Washington.

## ANNOUNCEMENTS.

**MEETINGS**—The next *evening* meeting of the Society will be held Wednesday, December 16th, at 8 o'clock, when a paper by Charles E. Emery, M. E., giving "An Account of Experiments made with compound and non-compound Engines" will be read, and the one by Prof. Robert H. Thurston, on the "Efficiency of Furnaces burning wet Fuel" will be discussed.

The next stated meeting of the Board of Direction will be held Monday, January 4th, at 2 o'clock P. M., for the transaction of regular business.

The next *afternoon* meeting of the Society will be held Wednesday, January 6th, at 1 o'clock, when ballots for members will be canvassed, the report from the Committee on "Rapid Transit and the Handling of Freight in New York" will be laid before

the Society, the Norman Medal formally presented, and other business taken up.

At the *evening* meeting, to be held January 20th, the paper by J. James R. Croes, C. E., on the "Construction of a Stone Dam" (for which the Norman Medal was awarded) will be discussed.

**ADVANCE COPIES OF PAPERS** thus announced for discussion will be sent on request, to members who wish to take part.

**PAPERS FOR THE NORMAN MEDAL.**—Members are invited to prepare papers to compete for this prize of merit. The conditions of the award are set forth in the Code of Rules, published in April Proceedings, page 78, and for the information of those who may not have this number of Transactions, reprinted on the page opposite this.

# AMERICAN SOCIETY OF CIVIL ENGINEERS.

## PROCEEDINGS.

### MINUTES OF MEETINGS.

(Abstract of such as may be of general interest to members.)

#### OF THE SOCIETY.

DECEMBER 16TH, 1874.—A stated meeting was held at 8 o'clock P. M.  
The reading and discussion of papers as announced was postponed, and the members present engaged in conversation on professional matters.

JANUARY 6TH, 1875.—A regular meeting was held at 1½ o'clock P. M.  
The vote on admission to membership was canvassed, and the following declared elected—Members, Messrs. Thomas L. Casey, of Washington, D. C., Joseph N. Du Barry, of Baltimore, Md., Niles Mitander and George S. Morrison, of New York, Galen W. Parsons, of Ogdensburg, N. Y., and Sutherland M. Prevost, of Bedford, Pa.; Associate, Mr. Edmund L. Du Barry, of Washington, D. C.; and Juniors, Messrs. William L. Baker, of Detroit, Mich., Charles O. Brown, of Paterson, N. J., Charles L. Burdett, of Hartford, Conn., George Burnham, Jr., of Philadelphia, Pa., and William B. Knight, of Washington, D. C.

The death, on December 19th last, at Toledo, Ohio, of Col. Eddy D. Mason, late Member of the Society, was announced, and Messrs. Willard S. Pope, Warren Colburn and Thomas C. Clarke were appointed a committee to present a memorial of the deceased.

The President appointed Mr. William P. Shinn, Capt. Otho E. Michaelis and Mr. William Metcalf members resident in Pittsburgh, of the Standing Committee on Conventions for the current year.

In consequence of the absence from the city of the chairman of the committee on "Rapid Transit and the Handling of Freight in and about New York," the report was not complete; the Norman medal had not been received from the mint; the presentation of both was, therefore, deferred.

#### OF THE BOARD OF DIRECTION.

JANUARY 2D, 1875.—A stated meeting was held at 2½ o'clock P. M.  
Proposals for admission to the Society, and the investment of its funds, were considered.



The Treasurer made a detailed report, which was accepted, and he was thanked for his earnest and faithful care of the Society's finances during the past 21 years.

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## MEMOIRS OF MEMBERS

WHO DIED IN 1873-4,

APPENDED TO THE ANNUAL REPORT OF THE BOARD OF DIRECTION.

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JONATHAN CAMP, Jr., C. E., was born January 22d, 1838, in the town of Norwalk, Connecticut. He received a liberal education in his native State and in the year 1853 entered the Rennsalaer Polytechnic Institute at Troy, New York, for the purpose of receiving the mental training necessary to the practice of the profession of a Civil Engineer. After passing two years and a half at the Institute, with credit to himself, he was obliged, by sickness, to give up the further prosecution of his studies, and sought to recover his health by engaging in active operations in the field.

His first engagement was with Messrs. J. B. & D. E. Culver, city surveyors, Jersey City, and resident engineers in charge of the construction of Bergen tunnel. Mr. Camp was intrusted with the immediate charge of this important work and remained until its temporary suspension, in 1857. Some two years afterwards he formed a partnership with the Messrs. Culver, as city surveyors, which continued about one year, after which, owing to general depression in professional work, he returned to his native place and took charge of a flouring mill. In 1865 he married and accepted an appointment as resident engineer on the Reno Oil Creek & Pit Hole R.R. At the expiration of a year the work was suspended and Mr. Camp returned to Jersey City and formed a partnership with Messrs. R. C. Bacot and Levi W. Post, as city engineers, during which time he executed many important public works. As chief engineer he built the Hackensack & New York Extension R.R., now the New Jersey & New York R.R.; he was also chief engineer of what was known as the Parallel R.R., from New York to Derby, Conn. Upon the dissolution of the partnership, in 1872, he became connected with the Department of Public Works, Jersey City, as one of the Board of Surveyors, which position he held until within a few months of his death, April 16th, 1874.

He was admitted as Member December 31st, 1873, and it is to be regretted that, by his early demise, he was prevented from forming intimate associations with a larger number of his fellow-members. Mr. Camp was possessed of many of the qualifications which, had he been spared, would have enabled him to command a prominent position in his profession. He was a man of immense energy and sound judgment, and in his intercourse with his associates he ever left the impress of a warm heart and generous disposition.

## NOTES AND MEMORANDA.

Members are desired to contribute selections from their note books and similar records of experience referring to engineering practice, and those seeking information are asked to suggest professional topics for discussion.

## CANALS.

HON. WILLIAM J MCALPINE, PAST-PRESIDENT, at the dinner of the Twenty Second Annual Meeting, responded to the fourth regular toast, "Our Canals."\*

Canals are imitations of Nature's navigable water-courses, and in their relations to commerce the two must be considered together. The several continents are alike, in each having a central plateau of no great elevation, from which great rivers radiate to the surrounding oceans. Most of the rivers of the old world have been navigated from historic times, and with the inland seas have marked the seat of empires, and determined the lines of the flow of migrating and conquering nations.

Herbert Spencer, who was an engineer before he was recognized as a philosopher, says: "The earliest recorded civilization grew up in hot and dry regions, and from within these or on their borders came all the conquering nations of the world." Great water-courses marked the line of early conquest in the old world, nor was America an exception to Spencer's statement, for the dry and nearly rainless districts of Mexico and Peru were also centres of civilization.

The right arm of the great conquerors in all time, has been an engineer; his skill was combined with that of the greatest military and administrative talents in the early history of Greece and Rome, and even of modern times.

The progress of canal navigation and its engineering can be readily traced from the rudest conditions of life. For man, as a hunter, the pathway of the various animals was sufficient. He could paddle a floating log across a river, or use a dug-out tree, and for greater distances or burdens could construct a raft; on this to place a floor and sides made water-tight was but a step, or, instead of a canoe, hides sewed together stretched over boughs of trees as ribs, and pitched—perhaps were the first boats; such as were employed in the grain traffic between Britain and the continent. The paper boats of the

Nile were followed by those shingled with strips of thorn, but long before this the ships of Tyre were built of planks of the "cedar of Lebanon." The Phœnicians and Arabians built vessels strong enough to withstand the tempests of the ocean, and from these came the great navies of the succeeding nations.

The skillful artists and redundant population of South Eastern Asia supplied gold, silks and spices to exchange for the metals and furs of the western and northern nations, and nature seemed to have adapted its products to suit the capacity of these earliest vehicles of transport.

The configuration of the eastern hemisphere and the near approach of the Red and Mediterranean seas suggested the first, and up to this time the only inter-oceanic canal. Sesostris opened a water line between the Red Sea and the Nile, with which no engineering work in history compares in importance, or in its results upon commerce and civilization. There is no historical account of canals for navigation during these early times, though for irrigation they were numerous, and were known to have been used to float corn to market. The Romans of the later empire used the rivers of Gaul to transport materials of war and food for their armies, and cut many canals across, or to shorten the land portages to the Bay of Biscay, and the German and Baltic seas.

For many centuries the ingenuity of man had provided no other method of conducting canals over elevations than by flushed sluices—inclined planes—in imitation merely of the natural water courses. In the fourteenth century a master-mind, such as appears in almost every age, a man eminent as an artist, but not so frequently spoken of as an engineer, Leonardo da Vinci, was the first to use the modern double gate canal lock; and the real inventor preceded him only two years.

The first illumination after the dark ages was given by the North Italian engineers, who, for two hundred years, constructed their own canals and those of France, connecting the old Roman portages through the kingdom

\* A corrected reprint of page 178 *Proceedings*.

of Charlemagne with water-lines of transport, which have continued sources of wealth to the present day.

Later, in England, James Brindley built the Duke of Bridgewater's canal, and Telford, the father of English engineering, followed with locks, gates and aqueducts of iron; thus anticipating what the younger members of this Society will in their day witness in universal use.

Our own country exhibits the best examples of this system of inter-communication by water. The great chain of lakes approaches so near the ocean on the northern boundary of this State, that an artificial canal was necessary to avoid the cold, inhospitable debouchment of the St. Lawrence, and the seventh modern wonder of the world—the Erie Canal—was built.

The idea of connecting the fertile West with its Atlantic market, was also seized by Pennsylvania and Virginia, and their canal systems followed. Overwhelming corporate influence destroyed the former, and apathy the latter—neither has proved a commercial success. Ohio, Indiana and Illinois have each built extensive canals to connect the navigable waters of the Ohio and Mississippi with the artificial outlet from the Lakes to the port of New York. The infancy of a new and sparsely settled country rendered these canals premature, and they have all gone into decay, except that great one connecting Lake Michigan with the Mississippi. But some of these

water-lines, as the one through Pennsylvania and Virginia, and those through Ohio and Indiana, must soon be re-established.

The inauguration of railways produced such wonderful changes in transport that the unreflecting mind of the public was easily led away in its enthusiasm to believe that the days of canals were ended, and the existing ones were to be filled and railway tracks laid in them. A more extended examination of the matter will show the error of this opinion. Each of these systems has appropriate functions to perform. The necessities of the age require quick transit of news and people; the telegraph answers the demands of one, and the railways of the other. But no human skill can supersede the laws of nature; an entire season is required to bring a crop to maturity, and a considerable time to harvest and transport it. The latter is so small a portion of the whole time, and the bulk of the product is so great in proportion to its value that it will not compensate for the extra cost of railway carriage.

The engineers of to-day have developed the present system of transport by railways, but the necessities of the times demand improvements in the existing canals, and the construction of new water-lines for the cheap movement of the immense production of agriculture at the West.

In the hands of the younger members of our Society, at no distant day, canals will be a "renaissance."

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#### NEW BOOKS ON

### ENGINEERING AND TECHNOLOGY.

Under this head will be announced new books on these and kindred subjects published in English, French and German, which may be professionally useful to members of the Society. The original titles of foreign books noted here will be furnished, on request.

At the present rates of duty and exchange, the cost of imported books may be estimated in federal money, at one shilling equal to 50 cents, and one franc to 37 cents.

Agriculture, *Cyclopedia of*—John C. Morton. New ed. London. 8vo. 2 vols. 50s.  
 Architecture of the Cistercians. Edmund Sharpe. London. 4to, illus. \$3.00.  
 Carbine; *Manual of Firing Exercises for the Snider Cavalry Carbine*. London. 1d.  
 Commerce and Navigation of the United States, *Annual Report of the Chief of the Bureau of Statistics on—*, for the fiscal Year ended June 30, 1873. Washington.  
 Commercial Cryptograph. A Telegraph and double Index *holographic Cipher*. J. G. Bloomer. New York. 8vo. \$5.00.  
 Drill, *Hand-book of Company, Battalion and Brigade*—St. Charles Slack. 10th ed. Clows. 32mo. \$5.

Earth, as Modified by human Action. New ed. of Man and Nature. George P. Marsh. New York. 8vo.  
 Earthwork, *Methods for the Computation from Diagrams of preliminary and final Estimates of Railway Earthwork, with Diagrams giving Quantities on Inspection to the nearest Cubic Yard, for both regular and irregular Sections, direct from ordinary Field-notes*. Arthur M. Wellington, C. E. New York. Part 1, Text. 12mo. Part 2, Diagrams. 4to. \$5.  
 Embryology, *Elements of*—M. Foster and Francis M. Balfour. London. 12mo, illus. \$3.00.  
 Energy, *An elementary Exposition of the*

- Doctrine of— D. D. Heath. London. 8vo. 4s. 6d.
- Engineers, Institution of Mechanical—, Proceedings August, 1874. Cardiff Meeting. Part I. 8vo, illus.
- , Transactions of the Society of— for 1873. London. 8vo. \$4 25.
- Explosives, Index to Report of Committee on Explosive Substances (Parliamentary). London. 8vo. 9d.
- Geography, Elementary Atlas of Physical— 16 Maps. E. Weller. London. 8vo. 1s.
- and Mineralogy—Part III of Manual for Civil Engineers. Paris (French). 10f.
- Geometry and Faith, A fragmentary Supplement to the Ninth Bridgewater Treatise. Thomas Hill. Revised and enlarged ed. New York. 12mo. \$1.00.
- Euclid, Elements of—; containing the first Six Books, chiefly from the Text of Dr. Simpson, with a Selection of geometrical Problems for Solution; to which is added the parts of the Eleventh and Twelfth Books which are usually read at the Universities. James Martin. London. 12mo. 3s. 6d.
- Gold and Silver Plate, Hall Marks in—, William Chaffers. 5th ed. London. 8vo. 12s. 6d.
- Grasses and Forage Plants. New revised ed. C. L. Flint. Boston. 12mo, illus.
- Heat; a Statement of the fundamental Principles of the mechanical Theory of—F. Massieu. Rennes (French).
- House; the Story of—translated from the French of Viollet le Duc, by George M. Towle. Boston. 8vo, illus. \$5.00.
- Hydraulic Construction; Hand-book of—Rivers, Sea Walls, Dams and Ship-Canals. 3d ed. Berlin (German).
- Hydraulics; Part VII. of Manual for Civil Engineers. Paris (French).
- Interest at one View; Tables of Simple Interest, at 3, 4, 4½ and 5 per cent., from 1 to 365 Days. 6th ed. Thomas Bowyer. London. 16mo. 3s. 6d.
- Irrigation; the Works of Irrigation of Upper Italy. Hanover (German).
- Latitude of a Place; Tables for finding—by Altitudes of Polaris. Washington. 8vo.
- Libraries, Report of the Commissioner of Education for 1872. Containing a List of Libraries (not private) of more than 1000 volumes. Washington. 8vo.
- Life Boat, History of— and its Work. Richard Lewis. London. 12mo, illus. \$1.75.
- Lightning Rods; Treatise on—A. Calland. Paris (French). 5f.
- ; Utility of—M. De Fovvielle. Paris (French).
- Locomotive Engineers and Stokers' Hand-book. Dijon (French).
- Mechanics; Compendium of—Prof. E. Burat. Paris (French). 31f.
- ; Course of Applied—Prof. Tresca. Paris (French).
- Resistance of Materials. M. Mastaing. Paris (French). 15f.
- Part IV. of Manual for Civil Engineers. Paris (French).
- Principles of— and their application to prime Movers, Naval Architecture, Iron Bridges, Water Supply, &c.; their Dynamics, with special Reference to the Steam Engine. W. J. Millar, C. E. Glasgow. 8vo. \$2.00.
- Metallurgy of Iron; Treatise on—M. Gruner. Paris (French).
- Patents—Reports of Cases arising under Letters Patent for Inventions, determined in the Courts of the United States. Commenced by Samuel S. Fisher and completed by John E. Hatch and Robert H. Parkinson. Vol. 6. Cincinnati. 8vo. \$25.00.
- Specifications and Drawings of Patents issued from the U. S. Patent office for June, 1874. Washington. 8vo.
- Petroleum and other Mineral Oils utilized by carburetting Air, and rendering it inflammable. Owen C. D. Ross. London. 8vo. \$1.50.
- Protoplasm; Being an Examination of Dr. James Hutchins Stirling's Criticism of Prof. Huxley's Views. James Ross. London. 8vo. 3s. 6d.
- Physics and Chemistry, being Part II Manual for Civil Engineers. Paris (French). 16f.
- Punctuation, General Rules for—, and for the Use of Capital Letters. Boston. 12mo. 80.25.
- Railroad Engineers, Manual for— and for Engineering Students. G. L. Vose. 2 vol. Boston. 8vo, illus.
- Railway Superstructures: Iron and Timber Railway and General Works, giving Dimensions and Quantities for the Standard and the Metre gauge. Also, applicable for light Railways, Steam Tramways, etc. J. W. Grover. London. Folio, illus. \$17.00.
- Railways in East India, Danvers's Report on —, for 1873-74 (Parliamentary). 1s.
- , Tyler's Report on Loan, Capital, &c., for 1873 (Parliamentary). 3d.
- Inspectors' Reports on Accidents, Part 4 (Parliamentary). 9d.
- Science, Advancement of— The Inaugural Address of Prof. John Tyndall, delivered before the British Association for the Advancement of Science, at Belfast, Aug. 19, 1874. 12mo. \$1.00.
- Sciopticon Manual. Explaining Marcy's new Magic-Lantern and Light, including Magic-Lantern Optics, Experiments, Photographing and Coloring Slides, etc. L. J. Marcy, 5th ed. Philadelphia. 16mo. \$0.50.
- Ship Builder, The—, Iron —; Engineer's and Iron Merchant's Assistant. H. Burlinson and H. Simpson. New ed. London. 8vo. 25s.
- Shipping, Annual Statement and Tables of the Navigation and Shipping of the United Kingdom for 1873. 3 parts. London. 3s. 2d.
- Sound, Transmission of— by the Atmosphere. John Tyndall. Gigantic Cattle-Fish. W. Saville Kent. New York.
- Stars, The Origin of—, and Causes of their Motions in their Light. 4th ed. J. Ennis. New York. 8vo.
- Steam Engines; Part. of VIII Manual for Civil Engineers. Paris (French).
- ; Principles of—T. M. Goodeve. London. 12mo, illus. \$1.50.
- Tables, Pocket Calculations for the Use of Timber Merchants, Builders, Contractors, Carpenters, Joiners, Packing-case Makers, Pianoforte Manufacturers and all Buyers and Sellers of Wood. W. Richardson. London. 8vo. 4s.
- Telegraph Engineers, Journal of the Society of—, Ed. by Frank Bolton and George E. Preece. No. 7. London. 8vo. \$2.00.

## ADDITIONS TO LIBRARY AND MUSEUM.

NOTE.—Members and others are asked to contribute regularly to the library of the Society, copies of government, municipal, railway, canal and other reports, specifications, profiles, maps, photographs and like matter, making up the record of engineering operations for the past or present, and to inform the Secretary where such may be had. Duplicate copies are desired, for transmission to foreign societies in return for works collected and sent to this library by them; also for exchange with members and others who wish complete sets referring to particular subjects. In order to gather material now considered of but little value, but of great future importance in the history of the public works of this country and a comparison of their economical results, donations are solicited of old reports or pamphlets, which in any way refer to their construction or operation.

### DONATIONS ARE ACKNOWLEDGED AS FOLLOWS:

From Phineas Barnes, Pittsburg, Pa.:  
Harsimus Cove—Plan to develop by Railroad Companies. Ashbel Welch. nenton. 1869.  
Memorial of the Manufacturers of Iron and Steel.

Texas & Pacific Ry.—Showing Surveys and completed Road. 2 maps.

Union Pacific R. R. Report of the Chief Engineer for 1866-9. 8 nos.—With map.

U. S. Revenue Commission—Manufacture of Railroad Iron. Interrogatories of the Commission, with Answers. By D. J. Morrell.

From Hon. S. B. Chittenden, Washington, D. C.:

Acts and Resolutions of the U. S. 1st Sess. 43d Congress. Washington. 1874.

Annual Report on the Commercial Relations between the U. S. and foreign Nations, Made by the Secretary of State. Sept. 30, 1873.

Memorial Addresses on the Life and Character of Charles Sumner.

Message from the President. 2d Sess., 41st Congress—3d Sess., 42d Congress. With Reports of Heads of Departments. 2 vols. Report of Select Committee on the affairs of the Union Pacific R. R. and the Credit Mobilier.

\_\_\_\_\_ on Transportation and Routes to the Seaboard. With Appendix and Evidence.

\_\_\_\_\_ on alleged Credit Mobilier Bribery. February 18th, 1873.

From Civil Engineers' Club of the Northwest. Chicago, Ill.:  
Foundations No. 7. Paper read at the Club by William Bryson, C. E.

From Clarke Reeves & Co., Philadelphia, Pa.:  
Girard Avenue Bridge. Philadelphia. One framed photograph—and five small ones.

From Francis Collingwood, Brooklyn, N. Y.:  
Specification for Anchor Bars, Brooklyn Anchorage, East River Bridge.

From Hon. S. S. Cox, Washington, D. C.:  
Acts and Resolutions of the U. S. 1st Sess. 43d Congress. Washington. 1874.  
Compendium of the Ninth Census. F. A. Walker. Washington. 1872.

Memorial Addresses on the Life and Character of Charles Sumner.

Message from the President. 1st Sess. 43d Congress. With Reports of Heads of Departments.

Papers Relating to foreign Relations of the U. S. 2 vols. Washington. 1873.

Report of the Commissioner of Education for 1872. Washington.

\_\_\_\_\_ on the Sea Fisheries of the South Coast of New England. 1871-2. Spencer F. Baird. Washington.

\_\_\_\_\_ of Select Committee on the affairs of the Union Pacific R. R. and the Credit Mobilier.

\_\_\_\_\_ on alleged Credit Mobilier Bribery, February 18, 1873.

From Hon. Roscoe Conkling, Washington, D. C.:

Annual Report of the Smithsonian Institution. 1871-2.

\_\_\_\_\_ on the Commerce and Navigation of the U. S. June 30, 1873.

\_\_\_\_\_ State of the Finances.

December 1, 1873

\_\_\_\_\_ of the Commissioner of Agriculture for 1872.

\_\_\_\_\_ U. S. Coast Survey for 1870.

Statistics of Mines and Mining in the States west of the Rocky Mountains. 5th Annual Report. R. W. Raymond.

From Joseph P. Davis, Boston, Mass.:  
Reports on an increased Supply of Water from the Cochituate and Mystic Lakes combined. City Document No. 85. Boston. 1874.

From Theodore G. Ellis, Hartford, Conn.:  
Proceedings of the Central Society of Civil Engineers, Paris, from March, 1848, to December, 1873. inclusive. (French.) 101 nos. Also statutes, blanks and forms.

From Charles D. Fox, London.:  
On the fixed Signals of Railways. R. C. Rapier. With an Abstract of Discussion on the Paper. Proceedings Institution of Civil Engineers. 3 copies, with 3 photographs. Also descriptive sheets.

From Charles K. Graham, New York.:  
Map, showing the high and low Water Mark, and the original City Grants of Lands under

Water, made to various Parties, from 1686 to 1873. Extending from Battery to 51st Street, Hudson and East Rivers, New York City. Also the several Pier and Bulkhead Lines established from 1730 to 1873. Made under the Direction of the Department of Docks, 1873. By Chas. K. Graham, Engineer-in-Chief.

From J. W. B. Grant, New York.:  
Fire at Granite Mill, Fall River, a Report.

From Maj. Peter C. Hains, Engineer  
Sec'y, Light-house Board, Washington, D. C.:  
Specifications for Light-house, Thirty Mile Point, Lake Ontario. 2 nos. and 20 plates.

From Gen. A. A. Humphreys, Chief of Engineers, U. S. A., Washington, D. C.:  
Improvement of Roanoke River.

Reports, &c., of Engineer Corps, U. S. A., as follows, relating to:

Bar of Sabine Pass, Texas. 2 copies.

Breakwater at Duluth.

Bridging the Channels between Lakes Huron and Erie.

Bridge at Davenport, Iowa, of the Chicago, Rock Island & Pacific R. R.

— across the Mississippi River, at St. Louis.

— over the Potomac River (the Long Bridge), at Washington.

— over the Schuylkill River, at South street, Philadelphia.

— over the Yazoo River, on Memphis & Vicksburgh R. R.

Bridges over the navigable Waters of the U. S., Draft of a Bill to regulate the Construction of—.

Canal; the Chesapeake & Ohio, its Extension to the Ohio River. 2 reports.

— the James River & Kanawha—  
Channel in Berwick Bay, at mouth of Atchafalaya River.

Falls of St. Anthony; Preservation of—.

Forts and Batteries; Appropriation for—to be expended.

Harbor at Galveston, Improvement of—.

— Survey of Grand Marais—of Lake Superior.

— at Kenosha, Wis., Condition of—.

— at Milwaukee, Condition of—.

— , Plymouth, Mass., Survey of—.

— of San Francisco—an Examination of the Wreck of the Ship Patrician, and Noonday Rock, at the Entrance of—.

Harbors of Refuge at Mouth of Sturgeon Bay; Progress of Work on—and the Lake Michigan Ship Canal, 1873.

Horn Island Military Reservation; relative to the Sale of—.

Island of Machinac, Mich. Information relating to its Dedication to public Uses. Ornithological Specimens collected in 1871, '72 and '73.

Powder Magazine; proposed Construction of—near Fort Mifflin, Delaware.

Presidio Military Reservation; present Condition of—, 2 reports.

Rivers and Harbors; Examination of certain—under Acts of Congress of March 3d, 1873.

— Connecting Lakes Huron and Erie, and Estimate of the Expense of Deepening and Widening the Channel of—.

— Flint and Chattahoochee; Survey of—.

River Coquille—Survey of the Mouth of—.

— Forked Deer—below Dyersburgh, Tenn., and the Red River of the North, from Moosehead Lake, Minn., to Pembino, Dak.

— Grand Calamut; Survey of—.

— Harlem—Raritan River, Crow Shoals, Old Horse Channel to Main Channel, to Pimlico Sound, entrance to Matagorda Bay and San Antonio Creek.

— Mississippi—Improvement of the Mouth of—2 Reports.

— Fort St. Philip Canal and the Construction of Jetties for the improvement of the Mouth of—.

— Survey of the upper—between Minneapolis and St. Cloud.

— Ohio. Improvement of—2 reports.

— Oostenaula and Coosawattee—Survey of—.

— Ouachita—Survey of—from Camden, Ark., to Trinity, La.

— Pawtucket—Past Improvement and present Condition of—.

— Rio Grande—Protection of River Banks of—on Site of Fort Brown, Texas.

— Saginaw—Survey and Improvement of—.

Ship Canal to connect the Mississippi River with Gulf of Mexico.

From J. G. Moore & Co., Elizabeth, N. J.:  
Creosoting—Bethell Process: (descriptive pamphlet.)

From Charles Paine, Cleveland, O.:  
Second Annual Report of the Commissioners of Railroads of Michigan. Dec. 31st, 1873.

From Potter Bros., New York:  
Map of the Northern Portion of the City of New York, comprising the 12th Ward, and the new 23d and 24th Wards, recently annexed under Chapter 613, Laws of 1873, State of New York, except that portion lying east of Broadway and St. Ann's avenue. Issued by Potter Bros., New York. (4 copies.)

From L. B. Prince, New York:  
The proposed Amendments to the Constitution, State of New York.

From C. P. Sandberg, London, England:  
Chart showing average Prices of Iron and Steel Rails for the past 20 Years.

From R. H. Terhune, Joliet, Ill.  
Steel Nail Manufacture, a Paper read before the American Institute of Mining Engineers.

From Prof. R. H. Thurston, Hoboken, N. J.:  
Announcement of the Stevens Institute of Technology.

From Andrew R. Trew, Buffalo, N. Y.:  
Model of Portage Bridge, Erie Ry.

From Gen. G. K. Warren, Newport, R. I.:  
Engineering Department, U. S. A. An Essay concerning the Valley of the Minnesota River.

From Arthur M. Wellington, New York:  
Methods for the Compilation from Diagrams of preliminary and final Estimates for Earth-work. Arthur M. Wellington, C. E. 2 vols.



From Welfton & Bonnett, Waterbury, Conn.:  
Sixth and Seventh Annual Reports of the Water Commissioners of the City of Waterbury.

From J. J. Williams, Jackson, Tenn.:  
Engineers' Report of the Jackson, Tennessee River & Birmingham R. R. 2 nos.  
Williams' improved Fish Bar Joint for Rail Fastenings. (Descriptive pamphlet with lithographs.)

From Hon. William Windom, Washington, D. C.:  
Cheap Transportation Speech delivered in U. S. Senate, April 24, 1874. 2 copies.

Compendium of the Ninth Census. F. A. Walker. Washington. 1873.  
Congressional Directory. Feby. 24, 1874. 2 copies.  
Memorial Addresses on the Life and Character of Charles Sumner.  
Report on Routes to the Seaboard. 3 copies.  
— of the Select Committee on Transportation. 2 vols.  
— of Tour of Inspection of European Light-house Establishment. Maj. Geo. H. Elliot. Washington. 1874.

#### PURCHASED.

Specifications and Drawings of Patents, issued from the U. S. Patent Office for June, 1874. Washington.

## ANNOUNCEMENTS.

**MEETINGS.**—The next *evening* meeting of the Society will be held Wednesday, January 20th, at 8 o'clock, when it is expected that a report from the Committee on "Rapid Transit and the Handling of Freight in New York," will be laid before the Society, and the Norman Medal formally presented. The paper by J. James R. Croes, C. E., on the "Construction of a Stone Dam" (for which the medal was awarded), will be discussed, and other matters taken up.

The next stated meeting of the Board of Direction will be held Monday, February 1st, at 2 o'clock, P. M., for the transaction of regular business.

The next *afternoon* meeting of the Society will be held Wednesday, February 3d, at 1 o'clock, when ballots for members will be canvassed, the report from the Committee on "Rapid Transit and the Handling of Freight in New York" discussed, and other business taken up.

At the *evening* meeting to be held February 17th, the paper by Charles E. Emery, M. E., giving "An account of Experiments made with compound and non-compound Engines," will be discussed.

**ADVANCE COPIES OF PAPERS** thus announced for discussion will, as soon as issued, be sent on request to members who wish to take part.

**EXTRA POSTAGE AT LETTER RATES.**—That is, three cents per half ounce, is collected by the New York Post Office on all packages of books, pamphlets and other printed matter, author's copy and photographs sent to the Society, which have *any writing* upon the wrap-

per except the address; otherwise the postage on such is but one cent per two ounces. The name of the sender or the contents of the package must *not* be written on the wrapper, but it may be printed.

**PHOTOGRAPHS OF MEMBERS.**—By resolution of the Society, each member has been requested to furnish two photographs of himself, of the usual card size, as a means of promoting social recognition and intercourse. Those who have not complied with this request are specially asked to aid in making the collection complete, by speedily forwarding their photographs, endorsed with autograph and date.

**PAPERS FOR THE NORMAN MEDAL.**—Members are invited to prepare papers to compete for this prize of merit. The conditions of the award are set forth in the Code of Rules, published on following page, or a copy will be furnished to applicants.

**CHANGES OF THE RIVER AT KEMPE'S LEVEE.**—The plate attached to this number illustrates the paper of Caleb G. Forshey, C. E., on the "Levees of the Mississippi," in December Transactions, and should *face* page 277.

**A LIST OF MEMBERS OF THE SOCIETY.**—With their addresses will be issued with February Transactions, as a Supplement.

**THE NUMBER OF PAGES IN TRANSACTIONS** varies in the several issues, on account of the difference in length of the papers contained. It is proposed, however, to print full 600 pages during the current year; and what this number lacks for the first quarter has been included in the November and December numbers.

# AMERICAN SOCIETY OF CIVIL ENGINEERS.

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## PROCEEDINGS.

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### MINUTES OF MEETINGS.

(Abstract of such as may be of general interest to members.)

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#### OF THE SOCIETY.

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JANUARY 20TH, 1875.—A stated meeting was held at 8 o'clock P. M.; the reading and discussion of papers as announced was postponed, and the members present engaged in the discussion on professional matters.

The Secretary called attention to efforts being made to secure a suitable appropriation from Congress, and the appointment of a commission for a complete and thorough series of tests of American iron, steel and other materials largely used in engineering construction, of shapes and sizes employed in practice; to determine the elements of strength as well as to deduce the laws which should govern the adoption of new forms in the superior metals of this country.\*

Mr. Collingwood of the committee on "Rapid Transit and the Handling of Freight in and about New York," gave an outline of the work done in preparing the report, which is nearly finished.

Mr. Bogart, Chairman of the Committee on a "Change of the Society's Rooms," stated that various localities in the city had been visited, principally in 9th, 14th and 23d streets, without as yet a selection having been made. The committee was in communication with several kindred associations, with a view to arrange for occupying jointly a large meeting room, and perhaps a library and reading-room. It had been proposed that chambers be selected near a central and accessible point, as Union or Madison Squares, where non-resident members when in town could spend an evening, and some recommended, for the convenience of these, that lodging rooms and a restaurant be provided in the same building, though not by the Society. In conclusion he showed that 23d street and Broadway were about midway between the several prominent hotels of the city, and conveniently accessible to most of the resident membership.

The Chairman (Vice-President Roberts,) yielded to the request of members, and gave account of his observations as one of the U. S. Board of

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\* See page 201 for a letter referring to this matter.

Engineers on the improvement of the outlets of the Mississippi, particularly in reference to the report lately presented.

FEBRUARY 3D, 1875.—A regular meeting was held at 1 o'clock P. M.

The vote on admission to membership was canvassed and the following declared elected: Members, Messrs. Lefferts L. Buck of New York, Frederick T. Hampton of Chattanooga, Tenn., John McGee of Lima, Peru, and Aniceto G. Menocal of Washington, D. C.; and Juniors, Messrs. Ernest W. Bowditch of Boston, Mass., J. L. Gillespie of Minneapolis, Minn., John W. Hill of Dayton, Ohio, William A. Illsley of Milwaukee, Wis., and Charles P. Perkins of Elmira, N. Y.

The first Norman Medal was then presented to the successful competitor, Mr. J. James R. Croes, for his "Memoir of the Construction of a Masonry Dam." The President said:

Mr. George H. Norman, a Member of this Society, with a liberality which, I take this occasion to say, will ever entitle him to the warmest gratitude, not only of the Society who is directly benefited by his munificence, but of the public at large, who, not less than ourselves, is interested in all that relates to the substantial improvement of our profession, has invested and made over to the Society a fund in safe securities, the income from which is to be appropriated yearly to the preparation of a medal in gold, as a premium for the best essay, memoir or paper offered in competition, on some branch of practical engineering.

The dies have been prepared, the medal struck, and you have before you the first premium which the American Society of Civil Engineers has been enabled to offer to its members as an earnest of its intentions and aims, outlined in the first article of our Constitution, as "the professional improvement of its members and the advancement of engineering in its several branches."

In our infancy, and, we may truthfully add, in our poverty, we could offer but little save our individual exertions to the furtherance of this end. Silver and gold we had none, and with the exception of the hope to lay the foundation of a library, the means through which we proposed to bring about great results were perhaps somewhat disproportioned to the end in view, but it was all we could promise at that day with any hope of redemption. Thanks to a Past President of the Society, we may say that we have the nucleus, if not the foundation, of a library; and now, through the munificence of one of our members, we have the institution of the Norman Medal.

The Board of Censors for the award of this medal, having, with perfect unanimity, chosen a paper as fulfilling the intention of the founder of the premium, it becomes my official duty, as your presiding officer, to declare the award of the medal, for 1874, to Mr. J. James R. Croes, of New York, for a "Memoir of the Construction of a Masonry Dam."

In presenting this, the first Norman Medal, allow me to congratulate you, Mr. Croes, on the preparation of a paper, the value of which is

not to be measured by the limited extent of the competition in which it bore off the prize, nor by the unusual character of the structure itself which constituted the theme of your memoir; neither by its magnitude, nor the important functions it is destined to perform in the future of this great city; nor by reason of the fitness of the design of the work to meet the end in view; but for the clear, concise and able treatment you have exhibited of that portion of the duty of a constructing engineer which, constituting his personal experience merely, is either thought of too little value for preservation in a useful shape, or if preserved, is locked up in an undigested form in his private note-book, and is thus of no value to his professional brethren. These are, on the contrary, the most valuable contributions which the engineer can present to his younger brethren. The value of analytic investigation embracing the higher calculus should not be overlooked; but the engineer will remember that it is at best but a means to an end, and that the end sought shall be attained the facts are of the first consequence; or, as Professor Huxley has very forcibly put it, "Mathematics may be compared to a mill of very exquisite workmanship, which grinds you stuff of any degree of fineness, but nevertheless, what you get out depends upon what you put in, and as the grandest mill in the world will not extract wheat flour from peas cods, so pages of formulæ will not get a definite result out of loose data."

Mr. Croes replied: I receive this medal, Mr. President, with feelings of gratification which I will not attempt to conceal. I will not say I thank you and your colleagues of the Board of Censors, for thanks imply a personal favor conferred, and the conditions and mode of award of the Norman Medal preclude the entrance of personal consideration into the matter. I may, however, and do thank you for the kind terms in which you have expressed your approval of the scope and mode of treatment adopted in the paper which has been so fortunate as to receive the first of what we hope will be a long succession of annual rewards, each of which will be a token to the recipient that his labors have not been altogether in vain, a token to the members generally that careful observation of facts and principles will not be overlooked, a token to those outside of the profession that the American Society of—not merely hydraulic, not merely mechanical, not merely railroad or topographical or bridge engineers, but of that which includes all these—of Civil Engineers, is in earnest in its endeavors to elicit from each of its members that which will benefit them all, and by benefiting them be of advantage to their clients, and these include all men whose condition can be bettered by public improvements.

The Report of the Committee on "Rapid Transit and the Handling of Freight in and about New York" was called for. A protest was presented against the adoption by the Society of any portion of the report recommending a special system or plan for rapid transit, setting forth reasons therefor and suggesting that the results of the Committee's

labors be submitted as personal or joint contributions to the papers of the Society, and by it published with the usual distinct disclaimer of any corporate responsibility. This was received and ordered on file.

Mr. Chanute, Chairman of the Committee, stated that the report was incomplete, and asked leave to submit it in a corrected form at an adjourned meeting of the Society to be held next week. After discussion, the report as prepared was read, its acceptance was considered, and finally the following was adopted :

Resolved, that the admirable report presented to-day be accepted with thanks, the Committee discharged, and the paper published in usual course as a paper contributed by the subscribing members of the Committee.

The following was proposed as an addition to the By-Laws, seconded, and action thereon set down for the meeting to be held March 3d next.

Section 31. No special committee shall be appointed unless on written notice given at a previous regular meeting of the Society.

#### OF THE BOARD OF DIRECTION.

FEBRUARY 1ST, 1875.—A stated meeting was held at 2 o'clock P. M. Proposals for admission to the Society, the investment of its funds, and the Treasurer's reports were considered.

The Committee on a "Change of the Society's Rooms" was authorized to lease suitable chambers conjointly with one or more kindred associations if possible, so that by mutual use of portions of the space occupied, the rental to each may be reduced.

### STATEMENT OF THE FINANCES OF THE SOCIETY,

PREPARED FROM THE TREASURER'S REPORTS.

#### RECEIPTS FOR 1873-4.

Past dues from 18 resident Members.....	\$470 00	
" 20 non-resident Members.....	320 00	
" 1 associate Member.....	10 00	
		\$800 00
Current dues from 84 resident Members.....	2 100 00	
" 209 non-resident Members.....	3 132 85	
" 14 Associates and Juniors.....	145 00	
		5 377 85
One-half dues from 6 resident Members.....	75 00	
" 21 non-resident Members.....	157 50	
" 1 Junior.....	5 00	
		237 50
Entrance fees from 48 Members.....	1 440 00	
" 6 Juniors.....	120 00	
		1 560 00
Carried over.....		\$7 975 35

Brought over.....		\$7 975 35
Publications sold.....	\$163 83	
Advertisements in Transactions.....	365 25	
Surplus of Convention Fund .....	6 35	
Return Premium on Insurance.....	2 00	
		537 43
Receipts for Year ending November 1st, 1874....		\$8 512 78
Cash Balance, November 4th, 1873.....		574 10
Total.....		\$9 086 88

## EXPENDITURES FOR 1873-4.

Salary.....	\$3 000 00	
Rent, Fuel and Janitor.....	966 00	
Library .....	120 82	
Stationery and Circulars.....	598 99	
Postage.....	248 93	
Printing, Copyright and Engraving.....	3 177 30	
Insurance.....	30 75	
Stenographer at Convention.....	50 00	
Expenses of Committee on Williamsburg Dam.....	64 50	
Expressage, Ice, Gas and Sundries....	44 21	
Expenditures for Year ending November 1st, 1874.....		\$8 301 50
Cash Balance .....		\$785 38

## STATEMENT OF ASSETS, NOVEMBER 1st, 1874.

Library and Furniture (estimated).....	\$4 600 00	
McAlpine Library—insured for.....	2 000 00	
		\$6 600 00
Fellowship Fund.....	7 700 00	
Norman Medal Fund—New York City Bond, par value.....	1 000 00	
Five Shares New York Central Railroad Stock, cost .....	536 25	
Deposit in "Seaman's Saving Bank for Savings"—(to July 1st, 1874).....	727 37	9 236 25
Accrued Interest on Fellowship Fund.....	1 071 84	
Interest on Norman Medal Fund.....	70 00	
Cash balance as above.....	785 38	2 654 59
Members' past dues.....	1 720 00	
" current dues, 1874-5, payable November 4th, 1874.....	6 635 00	
		8 355 00
Total Assets*.....		\$26 845 84

## RECEIPTS AND EXPENDITURES FOR THE QUARTER ENDING FEBRUARY 1st, 1875.

	RECEIVED.	EXPENDED.	
In November, 1874.....	\$274 27	....	
" December, " .....	2 100 10	\$561 89	
" January, 1875.....	1 254 75	661 08	
	\$3 629 12	\$1 222 97	
Balance.....			\$2 406 15
" November 1st, 1874.....			785 38
On hand.....			\$3 191 53

\* The value of dies for the Norman Medal, and the dividends on the New York Central Stock accrued since April 2d, 1868, are not included.



NEW BOOKS ON  
ENGINEERING AND TECHNOLOGY.

- Ammunition, Notes on—(Publication of the English Government.) London. 2s.
- Architects, Hints to young—. George Wightwick. New, revised and enlarged ed. G. Huskisson Guillaume. London. illus.
- interior —. Containing 12 Designs and 8 Sections of Doors, Stairs, Window-Finish, Mantels, Wainscoting, etc., and 2 Elevations for Dwellings in French and Italian style. New York. folio, illus. \$3.00.
- Architecture, the ecclesiastical—of Ireland, to the close of the 12th Century, accompanied by interesting and antiquarian Notices of numerous ancient Remains of that Period. Richard B. Brash. Dublin. 4to, illus. 21s.
- , History of—in all Countries, from the earliest Times to the present Day, in 4 vols. 2d ed. James Fergusson. Vols. 1 and 2. London. 8vo. 63s.
- rudimentary—ancient and modern. Consisting of Vitruvius, translated by Joseph Gwilt; Grecian Architecture, by the Earl of Aberdeen; the Orders of Architecture, by W. H. Leeds; the Styles of Architecture of Various Countries, by T. Talbot Bury; and the Principles of Design in Architecture, by E. L. Garbett. London. 8vo, illus. 12s.
- , for use of Beginners and Students. W. H. Leeds, Talbot Bury and E. Lucy Garbett. London. 12mo, illus. 6s.
- Assyrian Discoveries : an Account of Explorations and Discoveries on the Site of Nineveh, during 1873 and 1874. George Smith. London. 8vo, illus. \$4.00.
- Astronomy. J. Norman Lockyer. London. 8mo, illus. 1s.
- , Outlines of—, Arthur Searle. London. 16mo. \$2.00.
- Botany.—British Wild Flowers. Considered in Relation to Insects. John Lubbock. London. 8vo, illus. \$1.50.
- , Elements of—, Thomas Moore. 11th ed. London. 2s. 6d.
- Bridge Trusses, Graphical Method for the Analysis of—extended to continuous Girders and Draw Spans. Charles E. Greene, Prof. Civil Engineering, Univ. of Mich. New York. 8vo, illus. \$2.
- Calculus, first Principles of differential and integral—and their Application; to which are added elementary Propositions on the Theory of Complexes. Alfred George Greenhill. London. 8vo. 6s.
- Cannon, Hand-book for 64-pound converted Gun—(Publication of the English Government.) London. 6d.
- Chemical Analysis, preserving qualitative—. A new revised ed. compared with the last German and English eds., and with the new Notation and Nomenclature. Prof. S. W. Johnson. New York.
- , Outlines of proximate organic Analysis, for the Identification, Separation and quantitative Determination of the more commonly occurring organic Compound. Albert B. Prescott, Prof. Chemistry, Univ. of Mich. New York. 12mo. \$1.75.
- Chemical Examination of alcoholic Liquors. A Manual of the Constituents of the distilled Spirits and fermented Liquors of Commerce and their qualitative and quantitative Determinations. Albert B. Prescott, Prof. Chemistry, Univ. of Mich. New York. \$1.50.
- Church Decoration : a practical Manual of appropriate Ornamentation. London. 8vo, illus. 3s. 6d.
- Civil Engineer's and Contractor's Estimate and Price-Book for 1875. Haskoll's. London. 8vo. 6s.
- Coal Regions of America: their Topography, Geology and Development. 3d ed., with Supplement. New York. 8vo, illus. \$5.00.
- Engineer's Pocket-Book for 1875. Weale's. London. tuck, illus. 6s.
- Evolution and the Origin of Life. H. Charlton Bastain. London. 12mo. \$2.50.
- Ferns; Synopsis Filicum, or, a Synopsis of all known Ferns. W. J. Hooker and J. G. Baker. 2d ed. London. 8vo, illus. Plain, 22s. 6d., colored, 28s.
- Fret-Sawing and Wood-Carving for Amateurs. George A. Sawyer, Boston. Sq. 16mo, illus. \$1.50.
- Geology, economic,—or, Geology in its Relations to the Arts and Manufactures. David Page. Edinburgh. 8vo. 7s. 6d.
- Geometry, Course of descriptive—for the Use of Colleges. William Watson. London. 4to. 18s.
- , Elements of—in 8 Books, or first Steps in applied Logic. Part I, Plane Geometry. L. J. V. Gerard. London. 8vo. 4s.
- Plane and Solid—Part I. George Webster and Alfonso Gardiner. Manchester. 12mo. 1s.
- Interest, Balance Time Interest Tables, compiled and arranged for the speedy Calculation of Interest at 80 Rates. T. R. Jones. 2d ed., London. 4to. 10s. 6d.
- Land Improver's Pocket-Book, John Ewart, and Land Valuer's Best Assistant. R. Hudson. London. Ob. 32mo. 7s. 6d.
- Valuer's Best Assistant. New ed., with Additions and Corrections. R. Hudson. London. Ob. 32mo. 4s.
- Magnetism, Elements of—and Electricity, with practical Instructions for the Performance of Experiments, and the Construction of cheap Apparatus. John Angell. New York, reprint. 16mo, illus. \$0.75.
- Maps, Suggestions as to the Preparation of district Maps, and of Plans for main Sewage and Drainage and Water Supply. Corrected to 1874. (Publication of the English Government.) London. 1s. 6d.
- Materials, Resistance of—new revised ed. Prof. De Volson Wood. New York. 8vo.
- Mechanics, a new Treatise on Elements of—establishing strict Precision in the Meaning of dynamical Terms, accompanied with an Appendix on duodenal Arithmetic and Metrology. John W. Nystrom, C. E. Philadelphia. 8vo, illus. \$4.00.
- Medical, Report of the medical Department of the Army for 1872. No. 14. Dr. Parkes on Hygiene for 1873; Reports on Water and Surface Soil at Cape Coast; Dr. Munro

- on malarious Fevers, Cholera, &c ; Prize Essay on Lung Disease among Soldiers, &c. (Parliamentary Report.) London. 8vo. 6s.
- Microscope and its Revelations. Wm. B. Carpenter. 5th ed. H. J. Slack, Asst. Editor. Philadelphia. 8vo, illus. \$5.50.
- Mineral Statistics of the United Kingdom of Great Britain and Ireland, for Year 1873, with an Appendix. Robert Hunt. (Publication of the English Government.) London. 2s.
- Mining, Principles of Metal Mining. J. H. Collins. New York, reprint. 16mo, illus. \$0.75.
- Mineralogy. Manual of determinative—and Blow-pipe Analysis; being the determinative part of Dana's Mineralogy. Prof. Geo. J. Brush, Sheff. Sci. School. New York. 8vo, illus. \$3.00.
- , Second Appendix to Dana's Descriptive Mineralogy, bringing the Work down to date. E. S. Dana and J. D. Dana. New York. 8vo, illus.
- , Text Book of—J. D. Dana and E. S. Dana. New York. 8vo.
- Monumental Brasses. Herbert Haines. 2 vols. London. 8vo. 12s.
- , Designs. C. and W. H. Foggett. New York. Folio, illus. \$10.00.
- Naval Ordnance and Gunnery. Com. A. P. Cooke, U. S. N. New York. 8vo, illus.
- New York—Report of the Regents of the University on the Boundaries of the State of,—transmitted to the Legislature, May 28th, 1873. Albany. 8vo.
- Planetary Motion, the general Integrals of —, Simon Newcomb. (Smithsonian Contributions to Knowledge. No. 281.) Washington. 4to.
- Price-Book. Builder's and Contractor's—(Lockwood & Co.'s, formerly Weale's), with which is incorporated "Atchley's Builder's Price-Book" and "the Illustrated Price-Book" for 1875. London. 12mo. 4s.
- Projectiles and rifled Cannon, a critical Discussion of the principal System of Rifling and Projectiles, with practical Suggestions for their Improvement, as embraced in a Report to the Chief of Ordnance, U. S. A. Cap. John S. Butler, Ordnance Corps, U. S. A. New York. 4to, illus.
- Proportion Tables, universal, J. D. Everett. London. Folio. 16s.
- Pinetum, the—a Synopsis of all the coniferous Plants at present known, with Descriptions, History and Synonyms. George Gordon. 2d ed. Enlarged. London. 8vo. 18s.
- Ready Reckoner, the infallible —, U. Coxhead. Edinburgh. 18mo. 1s.
- Rifle Exercises and Musketry Instruction, (Publication of the English Government). London. 1s.
- Rivers Pollution. 5th Report of Commission. Pollution arising from Mining Operations and Metal Manufactures. Vol. I. Maps. (Parliamentary Report). London. 2s. 8d.
- Siege of Savannah in December, 1864, and the Confederate Operations in Georgia and the 3d military District of South Carolina during Gen. Sherman's march from Atlanta to the Sea. Charles C. Jones, Jr., late Lieut.-Col. Artillery, C. S. A., and Chief of Artillery during the Siege. Albany. Sq. 12mo. \$2.00.
- Ships, unseaworthy—Digest of Evidence taken in 1874. (Parliamentary Report). London. 8vo. 6d.
- Short-hand, commercial—in 12 easy Lessons, arranged so as to be learned without the Aid of a Master. G. H. Wells. London. 8vo. 1s. 6d.
- Sign-Writing and Glass-Embossing. J. Calingham. 2d ed. London. 8vo. 5s.
- Steam Engine Indicator; the Use of—or practical Science for practical Men. Edward Lyman, C. E. New York. 16mo, illus. \$1.00.
- Transit of Venus : a popular Account of past and coming Transits, from the first observed by Horrocks, 1639, to the Transit of 2012, Richard A. Proctor. London. 8vo, illus. 8s. 6.
- Trigonometry, Key to plain Trigonometry, for the Use of Schools and Colleges. I. Todhunter, M.A. London. 12mo. \$3.00.
- Valleys and their Relation to Fissures, Fractures and Faults. G. H. Kinahan. London. 8vo, illus. 7s. 6d.
- Wages Tables, calculated for 56 Hours per Week, showing Wages due for  $\frac{1}{2}$  Hour to 56 Hours, at Rates from 2 Shillings to 30 Shillings per Week. Dundee. 12mo.

## ADDITIONS TO LIBRARY AND MUSEUM.

### DONATIONS ARE ACKNOWLEDGED AS FOLLOWS:

- From American Iron and Steel Association, Philadelphia:
- British Treaties of 1871-4. Letters to the President of the United States. H. C. Carey. Philadelphia. 1874.
- From G. W. R. Bayley, New Orleans: Report of the Levee Commission of Engineers to the Governor of Louisiana. New Orleans. 1875.
- From E. L. Corthell, Louisiana, Mo.: Sing Island Levee compared with Levees on the lower Mississippi. Louisiana. 1874.
- , Bonds, State of Ill. (Prospectus.) Hannibal. 1874.
- From Joseph P. Davis, Boston: Report of medical Commission on the sanitary Qualities of the Sudbury, Mystic, Shaw-shine and Charles River Waters; City Document No. 102. Boston. 1874.
- From the Essayon's Club, Willett's Point, N. Y.: Dynamite Works of the Atlantic Giant Powder Co., a Paper read before the Club, February, 1874. By Captain A. Makenzie.
- From Maj. P. C. Hains, Eng. Sec'y, U. S. Lighthouse Board, Washington: Memoir on the Lighthouse at Belle Isle. L. Fresnel. Washington. 1858.

From William R. Hutton, Baltimore: Annapolis Water Co. 1st Report of President, Directors and Engineers. Annapolis. 1867. Bridges, Aqueducts, &c. Ethiel Town on the Construction of— New York. 1831. Capitol Extension; Letter from Superintendent of—relating to the Dome. 36th Cong. 1st Sess. Washington.

—, Message from the President relating to Heating and Ventilating—. Washington.

Pamphlets relating to the Chesapeake & Ohio Canal Co., as follows:

Act for Relief of Preferred Bond-holders. New York. 1867.

Acts of the State of Virginia, Maryland and Pennsylvania, and of the United States. Washington. 1838.

By-Laws, Rules and Regulations in force April 1st, 1868. Washington.

Communication from the President of the Co.—relating to the Washington Branch. Baltimore. 1871. Do., to the Governor of Maryland, Dec 2d, 1845. Do., to the Stockholders, Annapolis, February 15th, 1870.

Court of Appeals of Maryland. Opinion in the case of Virginia, Maryland and the Co. Frederick, 1871.

Laws and Resolutions. Washington. 1855. Memorial of W. W. Corcoran and others. Annapolis. 1870.

Message of the Governor to the General Assembly of Maryland. Annapolis. 1870.

Proceedings of the President and Directors and Report of the Ch. Engineer. Washington. 1840.

— of the Stockholders, July 6th, Aug. 16th and 17th, 1843.

Reports (Annual) of the President and Directors, for 1873-'5, '37-'56, '58-'74. Do., Dec. 31st, 1870, and Dec. 13th, 1871. Do., for quarters ending Nov. 30th, 1872, and Feb'y 28th, 1873.

— of Committees, July 18th, 1836: July 16th, 1838: June 3d, 1855: August 2d, 1848, and November 27th 1850.

— of the Board of Internal Improvements, October 23d, 1826. Annapolis.

— to the Stockholders, on the Completion of the Canal to Cumberland, with general Outline of its History. Frederick.

— of W. R. Hutton, Cons. Eng., Annapolis. 1872.

Speech of G. W. Dyer and Letter of L. Deane.

Construction and Improvement of interior Lines of Navigation. Report of Committee of Commerce on—. 43d Con., 3d Sess.

James River and Kanawha Canal, Report of Committee of Commerce on—. Richmond. 1872. Do. on Lockage, Cost of Construction, &c. James M. Harris. Richmond. 1874. Survey of—Letter from Sec'y of War. 41st Con., 3d Sess.

Outlets for the Products of the West. Speech of Jas. S. Negley. February 13, 1873. Washington.

Virginia central Water Line. Speech of R. W. Hughes. January 17th, 1873.

Water Line Communication between the Mississippi and the Atlantic. Memorial of the Louisville and Cincinnati commercial Conventions to Congress. Do. of the General Assembly of Virginia. Richmond. Water Supply of Washington and George-

town; Report of Lieut. Meigs, with Survey, Plans and Estimate. 32d Con., 2d Sess.

From the Institution, Birmingham, England: Institution of Mechanical Engineers. Proceedings, 1874. Cardiff Meeting. Part I. Birmingham. 1874.

From John A. Judson, Newport, R. I.: Annual Report of Ch. Signal Officer for 1873. Washington.

From David Kirkaldy, London: Henderson's Process for purifying Cast-Iron for Foundry Purposes, and for converting Cast-Iron into Steel and Wrought-Iron. London. 1872.

Our present Knowledge of building Materials, and how to improve it. A Paper by Capt. Seldon. April 22d, 1872. London.

Prospectus I, Account of Experiments on the Strength, &c., of Iron and Steel. London. Results of an experimental Enquiry into the mechanical Properties of Steel of different Degrees of Hardness and under various Conditions. David Kirkaldy. London.

— of Experiments to ascertain the mechanical Properties, &c., of Pieces cut out of the broken Cast-Steel Crank Shaft of Screw Steam Ship "Jeddo." David Kirkaldy. London.

— of Experiments on riveted Joints and Steel Plates. David Kirkaldy. London.

From Col. W. E. Merrill, Cincinnati: Annual Report upon the Improvements of the Ohio, Monongahela, Great Kanawha and Wabash Rivers. Washington. 1874.

Reports upon Bridging the navigable Waters of the U. S., being Appendix of Annual Report of Ch. of Engineers, U. S. A., for 1874. Washington.

From Charles Macdonald, New York: Bell's Bridge, Corning Bridge and Delaware Bridge. 3 framed photographs.

From John Nader, Madison, Wis.: Transactions of the Wisconsin Academy of Sciences, Arts and Letters Vol. II. 1873-4. Madison.

From John W. Nystrom, Philadelphia: A new Treatise on Elements of Mechanics, establishing strict Precision in the Meaning of dynamical Term. John W. Nystrom. Philadelphia. 1875.

From the Phoenix Iron Co., Philadelphia:

Descriptive Catalogue of Wrought-Iron Bridges.

Phoenix Iron Co.'s Designs.

Useful Information for Architects, Engineer and Workers in Wrought-Iron.

From E. Pontzen, Vienna, Austria: Report on the Transportation of Freight, and the Machine Works of the Austrian Southern R.R. (German). A Gottschalk.

From the Publishers, New York: The Railway Monitor, A monthly Journal of general Railroad Intelligence. Vol II. New York. 1874.

From C. P. Sandberg, London, England:

Diagram of average Prices of Iron and Steel Rails for the last 20 years. (copies for distribution.)

## ANNOUNCEMENTS.

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**MEETINGS.**—The next *evening* meeting of the Society will be held Wednesday, February 17th, at 8 o'clock, when the paper by Charles E. Emery, M. E., giving "Account of Experiments made with Compound and Non-Compound Engines," published herewith, will be discussed; one by William H. Burr, C. E., relating to an "Approximate Determination of Stresses in the Eye-Bar Head," will be read, and other matters taken up.

The next *stated* meeting of the Board of Direction will be held Monday, March 1st, at 2 o'clock P. M., for the transaction of regular business.

The next *afternoon* meeting of the Society will be held Wednesday, March 3d, at 1 o'clock, when ballots for members will be canvassed, the adoption of an addition to the By-Laws proposed February 3d last moved, the report on "Rapid Transit in New York" discussed, and other business transacted.

At the *evening* meeting to be held March 17th, the report on "Handling of Freight in and about New York," will be discussed.

ADVANCE COPIES OF PAPERS thus announced for discussion will, as soon as issued, be sent on request to members who wish to take part. It is expected that the Report of the Committee on "Rapid Transit and the Handling of Freight in and about New York," will be ready for distribution by February 25th.

**TESTS OF IRON AND STEEL.**—(A letter to Congressmen and others interested).

Sir: The accompanying memorial\* partially explains the necessity and value of an exhaustive series of experiments, to determine the strength and other characteristics of American iron and steel, in the various forms used in construction.

The proper use of these materials in the arts is much dependent upon a definite knowledge of the strength and capacity, of not only the various forms in market, but of others readily produced and adapted to special purposes. This knowledge can best be obtained by logically arranged experiments, made by men capable of deducing from a series of results, the laws which will generally govern similar cases.

\*Adopted by the Society in Annual Convention, June 10th, 1874 (Proceedings, page 115).

Such experiments require knowledge, means and time: knowledge of what has already been done, and of what is desirable and possible in the future; means, not only as represented by capital sufficient to effect whatever is attempted in experiment, but by standing and acquirements which shall guarantee the results established, from doubt through jealousy or prejudice; and time sufficient to permit the adoption of a comprehensive plan and its being worked out day by day and detail by detail, until the pronounced questions in iron and steel manufacture and construction, are all decided.

Those to be benefited by such an application of effort and money are the engineers, architects and builders who are called on to place these materials in structures to resist strains and endure use; the manufacturers who make and put them on the market; the capitalists who supply the money; the Government as a unit, it being, especially in time of war, a very large consumer; and the people at large, whose lives, time and comfort are more or less dependent upon the application of these agents. Hence the public purse should supply the money and the public agents join in the work.

A Commission is suggested to be appointed by the President, made up of representatives of the Army and Navy, and of the professions of Civil and Mechanical Engineering, and empowered to take the testimony of experts, upon such points as may be elucidated by statements of their actual experiences and personal observations. It should also be authorized and directed, to arrange a thorough and complete series of experiments, to determine not only the strength and other properties of iron and steel in the shapes and of the qualities now offered in the market and used in construction (such experiments to be on parts full sized and subject to the ordinary conditions and surroundings of present use), but also to develop new and more desirable shapes, and to determine what effect the various methods of refining and working these metals, and the different admixtures of ores, fuels and fluxes and their products have upon their physical characteristics. As the same appliances can be employed to test other substances entering largely into building, the Commission should extend its investigations to these, so far as such can be done

without interference with the main inquiry with which it is charged.

There will be required for the purpose of making these investigations, a testing establishment equipped with apparatus adapted to applying any kind of stress or strain—pulling, thrusting, bending, twisting, shearing, punching, bulging, or striking—and in any amount up, to say six times the heaviest strain applied in practice.

A great number and variety of specimens will be required for experiment, and these should either be purchased in open market or made at the testing establishment, so as to secure shapes, sizes and quality corresponding with those of like articles in actual use. Each of these specimens, after it has been tested, should be preserved for further examination, and rooms and cases for this purpose should be provided.

The results of these experiments should be reduced so far as practicable to the tangible and useful shape of mathematical formula.

An appropriation will be required sufficient to provide the necessary buildings and suitable machinery, and defray expenses during the first year. Additional sums should be supplied annually as needed.

Your support is earnestly asked for this measure, which will add to our national wealth and well-being by aiding in the education of our people in one of the most useful, valuable and important of its industries; will largely reduce the loss of life by accident, and give to our iron and steel constructions that strength and symmetry, united with economy, which a thorough acquaintance with the strength and other properties of these metals will alone enable us to attain.

For the Committee.

G. LEVERICH, Secretary.

REPORT ON RAPID TRANSIT, &c.—The following was published in the New York daily papers:

AMERICAN SOCIETY OF CIVIL ENGINEERS, }  
February 5, 1875. }

A Committee of the Society, duly selected and appointed to this service, has for some months past had the question of rapid transit

in the city of New York, in all its phases of passenger and freight traffic, under examination. A report was presented to the Society at its semi-monthly meeting on Wednesday, the 3d inst. It is an able and exhaustive document, necessarily very extended and voluminous, and referring to diagrams and tables for a clearer comprehension of its subject matter. It was accepted and referred to the Library Committee for publication in the monthly Transactions of the Society, for dissemination among its members throughout the Union, as is usual with similar papers; but it will be understood that the Society does not, as a body, make a report on any subject, nor can it be held responsible for the report of a committee of its members on a local question of any kind, however well qualified the individuals composing the committee may be known to be, for the expression of a sound and reliable judgment on the subject referred to them.

In the present case, portions of the public interested in the proper solution of rapid transit in the city of New York are looking for the expression of professional opinion from this Society in favor of one or other of the existing schemes designed to meet the question. The Committee of the Society reports that no one plan presented is suitable to all localities in the city, and endeavor to establish the principles of construction which should govern under all circumstances of location, and by approving certain plans within specified limits, thus narrows the choice now to be made between three or four score of designs, to between three or four individual plans; hence the Report will be found a mine of information for all concerned in rapid transit in this city; but until printed in the Transactions, it is not a public document. In view of its importance, it will be issued at an early day.

J. W. ADAMS, President.

G. LEVERICH, Secretary

THE LIST OF MEMBERS OF THE SOCIETY—with their addresses, announced in January to be published as a Supplement to this number, is not quite ready. It will appear with March Transactions.

# AMERICAN SOCIETY OF CIVIL ENGINEERS.

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## PROCEEDINGS.

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### MINUTES OF MEETINGS.

(Abstract of such as may be of general interest to members.)

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#### OF THE SOCIETY.

FEBRUARY 17TH, 1875.—A stated meeting was held at 8 o'clock p. m.

A paper by William H. Burr, C. E., giving an "Approximate Determination of Stresses in the Eye Bar Head" was read and discussed:—the members present then engaged in conversation on professional matters.

MARCH 3RD, 1875.—A regular meeting was held at 1½ o'clock p. m.

The votes on admission to membership was canvassed, and the following declared elected Members: Messrs. Amory Coffin, of Phoenixville, Pa.; George E. Harding, of New York; Charles W. Howell, of New Orleans, La., and Jacob H. Linville, of Philadelphia, Pa.; and Juniors, Messrs. Wendell R. Curtis, of Hartford, Conn.; Frederick B. Howard, of Waverly, N. Y.; Lorenzo M. Johnson, of Keokuk, Ia.; Thomas Lafon, of Newark, and P. Porter Poinier, of Hoboken, N. J.

The Report of the Committee on "Rapid Transit," &c., was considered; a communication from Mr. Richard P. Morgan, jr., relating thereto was read, which the President was instructed to return to the writer, with the explanation that the Society is not responsible for views expressed in the Report, and cannot receive discussion thereon from non-members. It was ordered that the resolution of February 3d, referring to the publication of the Report, be printed on the first page of the same, and the distribution of advance copies of the Society's papers be restricted to members. Discussion on "Rapid Transit" was postponed to the regular meeting, April 7th next.

Action was taken relating to the rates of postage on Transactions, and to the annual dues of Resident Juniors. Three reports from the Committee on the "Means of averting Bridge Accidents" were received, ordered printed and set down for discussion at the next Annual Convention. The addition to the By-Laws, proposed February 3d, was considered and referred to the Board of Direction.



## OF THE BOARD OF DIRECTION.

MARCH 1ST, 1875.—A stated meeting was held at 2 o'clock p. m. Proposals for admission to the Society, the annual dues of Resident Juniors, and the rates of postage on Transactions were considered.

It was determined that the Society would, May 1st, vacate the rooms at present occupied; the Treasurer submitted the diploma of membership, and copies for distribution were ordered printed.

## NEW BOOKS ON

## ENGINEERING AND TECHNOLOGY.

- Adirondack Wilderness. Report on the Topographical Survey of—for 1873. Verplank Colvin. New York. 8vo, illus. \$5.00.
- Air, thermal and mechanical Properties of—100 cubic Feet at 60° Fah. undergoing changes of Temperature, Pressure and Volume—a chart. Prof. Robert H. Thurston. New York.
- Anatomy of the Invertebrata. C. Th. Von Siebold. Trans. from the German, with Additions and Notes, by Waldo I. Burnett. Boston. 8vo, \$5.00.
- Anthropology. Notes and Queries on—for the Use of Travellers and Residents in uncivilized Lands. By a Committee appointed by the British Association for the Advancement of Science. London. 12mo, 5s.
- Architectural Surveyor's Handbook. 9th ed. J. S. Hurst. London. 32mo, 5s.
- Architecture, History of—in all Countries. James Fergusson, 2d ed., 3 vols., complete. London. 8vo, illus. \$36.00.
- , Wooden and Brick Buildings, with Details. A. J. Bicknell. 2 vols. New York. 4to, illus.
- Atlas, the Cyclopadian—of general Maps, published under the Superintendence of the Society for the Diffusion of Useful Knowledge. New ed. London. Folio. 21s.
- Bird Life, being a History of the Bird, its Structure and Habits, together with Sketches of 50 different Species. A. E. Brehm. Trans. from the German by H. M. Labouchere and W. Jesse. London. 8vo, 25s.
- Boiler Attendants and Engineers, Directions and Hints for—Robert Wilson. Manchester. 8vo, 1s.
- Bridge Piers: Iron Cylinder—Calculations and Investigations necessary in designing Them. John Newman. London. 8vo, illus.
- Calculations, intuitive—24th ed. Daniel O'Gorman. London. 12mo, 3s, 6d.
- Ceramic Art in remote Ages. J. B. Waring. London. 4to, 84s.
- Chart, North Polar—Keith Johnson. London. Folded, in Case. 5s.
- Chemistry, inorganic—the non-metallic and metallic Elements. With a Section on Inorganic Analysis. Raphael Meldola. London. 12mo, 1s. 6d.
- Civil Engineer's and Contractor's Estimate and Price Book for home and foreign Service. Atchley's. London. 8vo, 6s.
- Coal Mines, a practical Treatise on the Gases met with in—J. J. Atkinson. New York. 18mo, \$0.50.
- Coal Trade. Compendium of Information relative to Coal Production, Prices, Transportation, &c., at Home and Abroad. Frederick H. Saward. New York.
- Compass, Admiralty Manual for the Deviations of—(Parliamentary Report), 4th ed. London. 8vo, 4s. 6d.
- Cone and its Sections. S. A. Renshaw. London. 4to, \$6.25.
- Creation, Origin of—or, Science of Matter and Force. S. R. Fraser and A. Dewar. London. 8vo, 8s.
- Cyclopadia, the American—a popular Dictionary of General Knowledge. Ed. by George Ripley and Charles A. Dana. Vol. X. Kinglet—Magnet. New York. 8vo, illus. \$5.00.
- Dam, Memoir on the Construction of a Masonry—for a Storage Reservoir. J. James R. Croes. New York. 8vo, illus.
- Doctrines of Descent and Darwinism. Oscar Schmidt. New York. 12mo, illus. \$1.50.
- Dictionary, American mechanical—being a Description of Tools, Instruments, Processes and Engineering. History of Inventions, general technological Vocabulary and Digest of mechanical Appliances. 3 vols. New York. 8vo, \$21.00.
- Directory; Zell's United States Business Directory for 1875. Classified List of Manufacturers, wholesale Traders, Jobbers, commission Merchants, and others who, from the Nature and Extent of their Relations, may have Transactions with other Cities or may be called upon with Advantage by Travelers, Agents, etc. Together with statistical Information on the Resources of the States and Territories, and a carefully compiled Appendix of the State and City Governments, etc., compiled by L. Colange. Philadelphia. 8vo, \$10.00.
- Encyclopadia Britannica. 9th ed. Ed. by Thomas Spencer Baynes; Vol. I. Edinburgh. 4to, illus. \$9.00.
- Engineering in Sweden. Christer P. Sandberg. London. 8vo.
- Engineers, annual Report of Gen. A. A. Humphreys, Chief of—U. S. A., for 1874. Parts I, II. Washington. 8vo.
- Engineer's Pocket-Book for 1875. Adcocks. London. 12mo, 6s.

- Geological Survey of New Hampshire. Prof. C. H. Hitchcock, State Geologist. Concord. 2 vols. 8vo, illus., with atlas.
- Geology, Text Book of—James D. Dana. 2d ed. New York. 12mo. \$2.00.
- Light-House Board of the U. S. Annual Report of— for year ending June 30th, 1874. Washington.
- Lands, our barren—the Interior of the United States West of the One Hundredth Meridian and East of the Sierra Nevadas. W. B. Hazen, Col. 6th Infantry, U. S. A. Cincinnati. 8vo. \$0.50.
- Locomotive, Catechism of—M. N. Forney. New York. 12mo. \$3.00.
- London, Metropolitan Handbook for Railways, Tramways, Omnibuses, River Steamboats, and Cab Fares. With Street, Environs, and Railway Maps, and other useful Information. London. 32mo, 1s, 6d.
- Lumber, Self Instructor on Lumber Surveying, for the use of Lumber Manufacturers, Surveyors and Teachers. Chas. Kinsley. Calais, Me. 12mo. \$2.00.
- Man, Histology and Histo-Chemistry of—A Treatise on the Elements of Composition and Structure of the human Body. Heinrich Frey. Transl. from 4th German ed., by Arthur E. J. Barker, and revised by the Author. New York. 8vo, illus. \$5.00.
- Map-drawing, easy Lessons in—James Monteth. New York. 12mo. \$0.15.
- Mechanical Engineering and Machine Making: a Series of working Drawings and practical Designs, including numerous Examples from the Paris and Havre International Exhibitions, with Papers on technical Subjects. Robert Scott Burn. London. folio, illus. \$36.25.
- Mechanics, applied—elementary Lessons on —. Robert S. Ball. London. 12mo. \$1.00.
- practical—elementary Introduction to —. John F. Twisden. London. 8vo. 10s. 6d.
- Micrographic Dictionary. 3d ed. Ed. by J. W. Griffith and Prof. Martin Duncan; assisted by Rev. M. J. Berkeley and T. Rupert Jones. London. 8mo. 52s. 6d.
- Microscopic Journal. Monthly. Vol. 12. London. 8vo. 10s. 6d.
- Monetary System. New—the only Means for securing the respective Rights of Labor and Property, and of protecting the Public from financial Revolutions. Edward Kellogg. Revised and edited by Mary Kellogg Putnam. 5th ed., with sketch of Auth'r. Philadelphia. 12mo. \$1.50.
- Money. Henry Carey Baird. Reprinted from the American Cyclopaedia. New York. 24mo. \$0.50.
- Ordinance Notes, No. XXXIII. Report of the Board on experimental Rifle Guns. 8 inch Rifle. Washington. Large 8vo. illus.
- Ordinance, Report of the Chief of —, to the Secretary of War, for the year ending June 30th, 1874. Washington. 8vo. illus.
- Nautical Magazine for 1874. London. 8vo. 15s.
- Paper, the Cost of—computed and tabulated for the Printer and Publisher. Eugene H. Munday. New York. long fol. \$1.25.
- Park, Fairmount Park and the International Exhibition at Philadelphia. 6th ed., rev. and enl. Philadelphia. 12mo. illus. \$1.00.
- Poisons, a Manual of Toxicology, including the Consideration of the Nature, Properties, Effects and Means of Detection of Poisons. John J. Reese, M. D. Philadelphia. 8vo. \$5.00.
- Porcelain, a Chromograph of the Bow, Chelsea and Derby Porcelain Manufactories; showing their simultaneous Progress and their various marks. Walter F. Tiffin. London. 8vo. 1s.
- Pyrotechny, the Art of making Fireworks. New ed. London. 12mo. 2s.
- Railroad Commissioners of the State of Massachusetts; Seventh Annual Report of the Board. Boston. 8vo.
- Railway Construction, elemental and practical Instructions on the Science of —. R. Macdonald Stephenson. 5th ed., revised and augmented. By Edward Nugent. London. 12mo. 4s.
- The Pennsylvania R. R., with Remarks on American Railway Construction and Management. Charles and Francis Fox. London. 8vo. illus.
- Rapid Transit and terminal Freight Facilities. Report of Committee of American Society of Civil Engineers. New York. 8vo. \$0.75.
- Rifle Manual and firing Exercises, for the Martini-Henry Rifle. (Parliamentary Report.) London. 8vo. 3d.
- Shipbuilders, the progressive—. John W. Griffith. New York. 4to. illus. \$6.00.
- Steam, safe Use of—, containing Rules for the Guidance of unprofessional Steam Users. By an Engineer. London. 12mo. \$0.25.
- Telegraphy, Instructions for Meteorological —, September, 1874. (Parliamentary Report.) London. 8vo. 6d.
- Transit of Venus in 1874. Robert Grant. Glasgow. 16mo. 1s. 6d.
- United States Register or Blue-Book for 1875. Containing the Names of the principal civil Officers of the federal Government Army and Navy List, etc., together with authentic political and statistical Information relating to the several States and Territories, Dominion of Canada, and other Portions of the Continent of America. Also, the official Census of the United States, including a Monetary Directory for the Cities of New York and Philadelphia, etc. Compiled by J. Disturnell. (24th Year of Publication.) Philadelphia. 8vo. \$2.00.
- Vienna Exhibition, Reports of Commissioners on.—. Vol. I. Colonial Produce, by W. Robinson; raw Materials, by Professor Archer; commercial and industrial Progress of Austria; Austrian Tariff; the Commerce of the World. Vol. II. Machine Tools, textile and other Machinery, by Dr. Anderson; stationary and portable Engines, by Mr. Holmes; agricultural Machinery, by Col. Michael; small Arms, the Art of War, by Dr. Russell; utilization of Peat and Peat Lands, by Mr. Paget. Vol. III. Influence of International Exhibitions, by Prof. Archer; characteristic Features of the Buildings, by Digby Wyatt; Pottery, Porcelain, and Glass, by Prof. Archer; small Wares and fancy Goods, by Mr. Mounsey; educational Appliances, by J. G. C. Fassell. Vol. IV. Wine and Beer, by Mr. Vizetelly; Food Products, by G. P. Bevan; international Horse and Cattle Shows, by Lieut. Anstey; International Patent Congress, by T. Webster; Yarn and Flax Congress, by Dr. Weissmann. Each 8vo. Vol. I. 5s. 9d. Vol. II, 7s. 6d. Vol. III, 6s. 3d. Vol. IV. 3s. 10d, with Appendix, Maps and Plans. 6s. London. (Publication of the English Government.)
- Weather Report of the Meteorological Office. Part III. July-Sept., 1873. (Parliamentary Report.) London. 8vo. 5s.

## ADDITIONS TO

## LIBRARY AND MUSEUM.

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- From American Iron and Steel Association, Philadelphia:  
Annual Report of the Secretary of—, to December 31, 1874. Philadelphia.
- From R. C. Bacot, Jersey City, N. J.:  
Reports of the Riparian Commissioners of the State of New Jersey, for 1873-1874. 2 numbers.
- From Gov. J. G. Bagley, Detroit, Mich.:  
Geological Survey of Michigan. Upper Peninsula. 1869-73. 2 vols. and :tlas of maps.
- From Gen. S. V. Benét, Chief of Ordnance, U. S. A., Washington:  
Annual Report of—to the Secretary of War, for year ending June 30, 1874. Washington.  
Letter of—to the Secretary of War, December 14th, 1874.  
Ordnance Notes, No. XXXIII. Report of the Board on Experimental Rifled Guns.—8-inch rifle. February 4th, 1875. Washington.
- From the Board of Railroad Commissioners of Massachusetts. Boston:  
Sixth Annual Report of the Board—January 1875. Boston.
- From Alfred P. Boller, New York:  
Iron Highway Bridge over Hudson River, Troy, N. Y.—framed photograph.
- From A. D. Briggs, Springfield, Mass.:  
Boston, Hoosac Tunnel & Western R. R. Co. Report of the Corporation. January, 1875. Boston.  
Report of the Water Commissioners of the City of Springfield. 1875.
- From Col. Thomas L. Casey, Washington, D. C.  
Report on the compressive Strength, specific Gravity and Rates of Absorption of various Kinds of American Building Stone. Gen. A. Gillmore. Washington. 1874.
- From Prof. C. F. Chandler, New York:  
The "Metalline" Controversy, in the American Institute. New York. 1875 (several copies).
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Maps of Syracuse and Geddes. Map of East Syracuse.
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Astronomical and meteorological Observations made during 1872 at the Observatory, Washington, 1874.
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Double Cylinder Engine. Schuylkill Water Works—photograph and plate.  
Pipe Aqueducts across Wissahickon Valley—plate.
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Annual Report of the Light-House Board of the United States, for the year ending June 30th, 1874. Washington (3 copies).
- From John W. Hogg, Chief Clerk, Navy Department, Washington.  
Navy Register of the United States, to January 1st, 1875.
- From Gen. A. A. Humphreys, Chief of Engineers, U. S. A., Washington:  
Annual Report of—to the Secretary of War, for 1874. Parts I, II. Washington. 1875.  
Reports upon the St. Philip Canal, and the Construction of Jetties for the Improvement of the Mouths of the Mississippi. Washington. 1874.
- From William R. Hutton, Baltimore, Md.:  
Tabular Statistics of the Cumberland Coal Trade from 1842 to 1874, inclusive.
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Sixth Annual Report of the Buffalo City Water Works. 1875 (3 copies).
- From Galen W. Pearsons, Oswego, N. Y.:  
Annual Report of the Memphis Water Co. April 30, 1873.
- From John Newman, London:  
Iron Cylinder Bridge Piers—Calculations and Investigations—necessary in designing Them. John Newman. London. 1875.
- From E. S. Philbrick, Boston, Mass.:  
Report of the Selectmen of Brookline, concerning a System of Sewerage. 1875.
- From E. Pontzen, Vienna, Austria:  
Final Report of the Completion of Canals of France. Vienna 1875. (German.)

From Riehle Brothers, Philadelphia:  
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From Christer P. Sandberg, London:  
Engineering in Sweden. London. 1875.  
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From Frederick E. Saward, New York:  
The Coal Trade, a Compendium of Informa-  
tion relative to Coal Production, Prices,  
Transportation, etc., at Home and Abroad.  
Frederick H. Saward. New York. 1874.

From T. Guilford Smith, Buffalo, N. Y.:  
Report of the Managers of the Philadelphia &  
Reading RR. Co. January 11, 1875. Phila-  
delphia.

From Robert H. Thurston, Hoboken,  
N. J.  
Thermal and mechanical Properties of Air.  
(a chart.)

From E. B. Van Winkle, New York:  
Vienna Universal Exposition, 1873. Official

Catalogue of the American Department.  
Edited by Eben Brewer. London.

From Maj. T. M. Vincent, Adjutant  
General's Department, Washington:  
Official Army Register for January, 1875.

From Miscellaneous Sources:  
Actual Drivings of the Curvo and common  
railroad Spikes in Oak and Pine. 4 photo-  
graphs.

Annual Report of the Hartford Steam Boiler  
Inspection and Insurance Co. September  
1st, 1874. Hartford, 1875. (2 copies.)

Letter from the Secretary of War, relative to  
the Act of June 23d, 1874, for making Sur-  
vey of the Mouths of the Mississippi.

Pisciculture, an address on the Artificial  
Breeding of Fish, by A. W. Clark. Detroit.  
1875.

Report of the Board of State Engineers to the  
General Assembly of Louisiana for 1874.  
New Orleans.

United States Centennial Commission. Inter-  
national Exhibition in Philadelphia, 1876.  
System of Classification.

## ANNOUNCEMENTS.

**MEETINGS.**—The next *evening* meeting of the Society will be held Wednesday, March 17th, at 8 o'clock, when "Handling Freight in and about New York," will be considered, a communication from Russell H. Curtis, C. E., on "Tests of Eye Bars" read, and discussions on Papers in Transactions, presented, as follows; by E. L. Corthell, C. E., on "Leaves of the Mississippi;" by Professor Robert H. Thurston, on "Efficiency of Furnaces burning wet Fuel," and by S. Whipple, C. E., on "Upright Arch Bridges."

The next stated meeting of the Board of Direction will be held Monday, April 5th, at 2 o'clock P. M., for the transaction of regular business.

The next *afternoon* meeting of the Society will be held Wednesday, April 7th, at 1 o'clock, when ballots for members will be canvassed, the report on "Rapid Transit in and about New York" discussed, and other business transacted.

THE SEVENTH ANNUAL CONVENTION of the Society will be held at Pittsburgh, Pa., on Tuesday, Wednesday and Thursday, June 8th, 9th, and 10th next.

Sessions for the consideration of profes-  
sional subjects, will be held from 9½ o'clock  
A. M., to 1½ P. M. each day, and one for the  
transaction of such regular business as may  
be brought up—at 7½ o'clock, on Tuesday;  
the Convention Dinner will be at 7½ o'clock  
P. M., on Wednesday, and the remaining  
available time devoted to semi-professional

excursions and meetings for social inter-  
course.

Papers for the Convention may be an-  
nounced by title, but none requiring more  
than ten minutes' time are to be read. Topics  
for consideration are to be selected from  
papers of the Society printed during the pre-  
ceding year. The order of proceedings will  
be announced in May Transactions.

Members desiring to offer papers, or to  
discuss topics, will please give early notice to  
the Secretary.

"MEMOIR OF THE CONSTRUCTION OF A MA-  
SONRY DAM."—Members are urgently request-  
ed to furnish from their own experience, as  
soon as practicable, memoranda or remarks  
on the subjects considered in this paper.  
(CIII. February Transactions.) They are  
thus classified:

- § 1—13. Location of Dam and Reservoir.
- § 14—24. Form and Stability of Masonry  
Dam.
- § 25—29. Changes in Plan from original  
Design.
- § 30—43. Analysis of Specification and Pro-  
posals.
- § 44—57. Progress of Construction; Obstacles  
to obtaining good Workmanship.
- § 58—62. Methods of handling and Character  
of Materials; Cost of Work.
- § 63—67. Tests of Cement.
- § 68, 69. Broken Stone.
- § 70—73. Mortar and Concrete.
- § 79, 80. Large Stone in Concrete.

- § 81, 82. Quarrying Stone for Cutting.
- § 83, 84. Stone Cutting.
- § 85, 86. Stone Masonry.
- § 87. Brick Masonry.
- § 88. Roads.

TESTS OF IRON AND STEEL.—The following is from an act passed March 4th last, "making Appropriations for Sundry Civil Expenses of the Government," &c.

"Be it enacted by the Senate and House of Representatives of the United States of America, in Congress assembled: that the following sums be, and the same are hereby appropriated, for the objects hereinafter expressed, for the fiscal year ending June" 30th, 1876. \* \* \*

"Section 4. That for experiments in testing iron and steel, including the cost of any machine built for such purpose, the sum of fifty thousand dollars is hereby appropriated; and the further sum of twenty-five thousand dollars provided 'for improved machinery and instruments for testing American iron and steel,' in the act entitled 'An Act making appropriations for the support of the army for the year ending June thirtieth, eighteen hundred and seventy-four,' approved March third, eighteen hundred and seventy-three, is hereby continued and made available for such purpose; and that the President be, and hereby is, authorized to appoint a board, to consist of one officer of the engineers of the United States army, one officer of ordnance of the United States army, one line officer of the United States navy, one engineer of the United States navy, and three civilians who shall be experts; and it shall be the duty of said board to convene at the earliest practicable moment, at such place as may be designated by the President, for the purpose of determining by actual tests, the strength and value of all kinds of iron, steel and other metals which may be submitted to them or by them procured, and to prepare tables which will exhibit the strength and value of said materials for constructive and mechanical purposes, and to provide for the building of a suitable machine for establishing such tests: *Provided*, That no officers in the pay of the Government shall be entitled to, or receive, any additional compensation by reason of any services rendered in connection with this board; but one of the civil experts shall act as secretary of the board, and shall be entitled, under this act, to such compensation as the President may deem proper and

fit: *Provided*, That not more than fifteen thousand dollars of the sum herein provided shall be used for the expenses of such board."

VOLUME III OF TRANSACTIONS ends with No. CVI. An index will be published with April Transactions. It is intended that the two parts of this publication shall be bound separately; with this view the paging of the two—"Transactions" and "Proceedings" is distinct. In due course, when a sufficient number of pages of the latter is printed, the volume will be closed and indexed also.

THE NUMBER OF PAGES IN TRANSACTIONS (as before announced) varies in the several issues, on account of the difference in length of the papers contained. Nos. CIII and CIV, in February Transactions, as well as Nos. CV and CVI herewith, are all long papers: it is thought best to include the latter—"Rapid Transit and Terminal Freight Facilities" in this issue to members rather than to wait a month.

A LIST OF MEMBERS of the Society, with their addresses, will be issued on the 25th inst. The types will be kept standing; members are requested to inform the Secretary of errors noted, that corrections may be made in subsequent editions.

CARD TO MEMBERS.—The following is from a circular issued December 10th, 1872.

"The Society should be of real and positive benefit to each member; that this in one way may result, the Secretary will endeavor to obtain experimental knowledge from experienced members, upon matters of practice, for those who request it; examine in the public libraries authorities upon special topics; select books, instruments, and similar 'material' for an engineer's equipment; and to execute other commissions within his province, of a professional character. Those seeking engagement, and those requiring engineering service are desired to communicate to him the particulars, that such may be brought together; and generally, all interested are urged to aid in rendering the offices of the Society a bureau of professional information to its members."

Members thus commanding the Secretary are requested to state explicitly what is required, and he will endeavor to execute their commissions with reasonable promptitude, *without charge*.

# AMERICAN SOCIETY OF CIVIL ENGINEERS.

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## PROCEEDINGS.

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### MINUTES OF MEETINGS.

(Abstract of such as may be of general interest to members.)

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#### OF THE SOCIETY.

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MARCH 17TH, 1875.—A stated meeting was held at 8 o'clock P. M.

The deaths on March 15th of Mr. James Laurie, late of Hartford, Conn., the first Member and President of the Society, and of Gen. William L. Dearborn, late of New York and Member, were announced. The appointment of committees to present memorials of the deceased was deferred till a regular meeting.

Communications as follows were read: from Russell H. Curtis, C. E., of December 12th, on "Tests of Eye Bars;" from Elmer L. Corthell, C. E., of January 9th, on "Levees of the Mississippi;"\* from Squire Whipple, C. E., of March 10th, on "Upright Arched Bridges,"† and from Hon. W. W. Belknap, Secretary of War, of March 15th, relating to the appointment of a Board to test iron, steel and other metals; each was briefly considered. Discussion of the topic previously announced—"Handling Freight in and about New York"—was called for and postponed to the next regular meeting.

APRIL 7TH, 1875.—A regular meeting was held at 1½ o'clock P. M.

The votes on admission to membership were canvassed and the following declared elected: Members, Messrs. Louis G. F. Bouscaren of Cincinnati, Ohio, and Edward C. Rice of St. Louis, Mo.; Junior, Mr. George P. Bland of Philadelphia, Pa.

Papers were presented and referred to the Committee on Library—on the "Fabrication of Beton Coignet by manual Labor," by Gen. Schuyler Hamilton, and on the "Delta of the Mississippi considered in Relation to an open River Mouth," by Gen. John G. Barnard; also a communication from Prof. Robert H. Thurston, of April 2d, accompany-

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\* Transactions, Vol. IV, page 85.

† Ditto, page 81.



ing a piece of T rail, designed 45 years ago by Mr. Robert L. Stevens, and laid on the Camden & Amboy R. R. in 1832.

The report of the Committee on "Rapid Transit," etc., was considered.\* A general discussion of the subjects of the report followed without conclusion, and it was made the order for the meeting on April 21st next.

The following were made an order of business at the Seventh Annual Convention, on June 8th, next :—

Resolved, that a committee be appointed to investigate the feasibility and propriety of organizing the Society—as a whole, or by voluntary membership—as a Mutual Benefit Society to aid and benefit the families of deceased members.

Resolved, that a committee of three members of the Society be appointed by the President, to investigate the varieties of nomenclature and classification used in different parts of the United States, to designate the several kinds of stone-cutting and masonry and the tools employed in such work and also the corresponding terms used by French, German and English writers on these subjects, and to inquire into the possibility of securing uniformity of practice in such nomenclature and classification.

Resolved, that a committee of three members of the Society be appointed to enquire into the feasibility of establishing a uniform system of gauging of streams and rivers of known water-shed, in connection with observations of rain-fall, and that such committee be empowered to request the co-operation of the Smithsonian Institution and the Franklin Institute in the matter.

Attention was called to a request that members who can do so, furnish samples of stone and bricks for testing.†

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#### OF THE BOARD OF DIRECTION.

MARCH 19TH, 1875.—A special meeting, called by the President at the request of members of the Board, was held at 3 o'clock P. M.

A communication from Hon. W. W. Belknap, Secretary of War, dated March 15th, relating to the appointment of a Board to test iron, steel and other metals, was presented and action thereon taken.

APRIL 5TH, 1875.—A stated meeting was held at 2 o'clock P. M.

Proposals for admission to the Society, and the investment of its funds were considered; the addition to the By-Laws—proposed February 3d, and referred to the Board by the Society in regular meeting March 3d last—was taken up and action thereon deferred, for the Secretary to report from the minutes as to the effect of such a By-Law on the transaction of the Society's business.

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\* This portion of Abstract is withheld for revision.

† See page 219.

## NOTES AND MEMORANDA.

TESTS OF SUSPENSION BRIDGE CABLES, 32 YEARS OLD. There were forwarded to the Secretary of the Society, some time ago, two pieces of suspension cable from the old Fairmount Bridge, at Philadelphia, which had just been taken down to give place to a new truss bridge. The old bridge was built by Ellet, in 1842. The following are particulars in regard to this structure:

Length of bridge, centre to centre	
of trusses.....	356.6 feet.
Length of floor between abutments.....	340.6 "
" " " weight on cables.....	336.6 "
Clear width of floor between	
trusses.....	25. "
Number of wire cables.....	10.
Diameter of each.....	3 inches.
Solid wire section, each.....	5.513 square inches.
Total section of the 10	
cables.....	55.135 " "
Mean length of cables between	
points of support.....	362.17 feet.
Mean deflection.....	27.3 "
Length of backstays.....	93.24 "
Weight of cables per lineal	
foot.....	186.58 pounds.
Weight of cables between	
supports.....	67 574 "
Weight of backstays.....	17 397 "
Weight of cables and back-	
stays.....	84 971 "
Number of suspenders.....	170.
Diameter " ".....	0.75 inches.
Solid wire section of sus-	
penders.....	0.344 square inches.
Total lineal feet.....	2 242 feet.
Weight of suspenders per lineal	
foot.....	1.106 pounds.
Total weight of suspenders.....	2 614 "
Weight of structure:	
Floor and trusses, 340.6x960.8	
pounds.....	327 248 pounds.
Cables and backstays.....	84 971 "
Suspenders.....	2 614 "
	414 833 pounds.
Weight carried to abutments:	
Floor and trusses 3 843 pounds.	
Backstays.....	17 397 "
Deduct amount.....	21 240 "

Total weight between points  
of support.....393 593 pounds.  
Being 1 103 738 pounds or 0.492 tons per  
foot run.

It was suggested that the wires submitted, be sent for test to Prof. R. H. Thurston (at the Stevens Institute of Technology), which was done, and the tests were recently made.

The test pieces were cut from the cable directly above the top of the tower, where it rested upon the saddle-plate. The cable was originally well protected by boiled oil freely applied, and the outside was painted with common white lead paint. Of late this outer protection had seriously deteriorated, and for some reason but little care had been taken of it. Foot passengers have been known to drive the blades of their pocket knives into the cables, separating the wires and enlarging the spaces which already admitted air and moisture. The piece from the top of the tower showed plainly that that part of the cable, also, had not been properly cared for, and many of the wires exhibited evidences of the fact that moisture had reached them. Corrosion, in these cases, had attacked the wire locally to the depth of about 0.01 inch, as measured at the time of testing them.

With these particulars, Prof. Thurston presents the tabular statement of results here appended.

As is shown in the first table, the average diameter of wire was 0.1236 inch, and mean breaking weight 1081 pounds, or about 90 000 pounds per square inch of original section, and about 160 000 pounds per square inch of fractured section. The ductility as measured by the ratio of those areas is quite high, the ratio being 0.5607. This would give an extension, were the wire of section uniformly from end to end as it is at the point of fracture, of 0.7922 its original length.

This is deemed by Prof. Thurston the best gauge of ductility, as the usual method of measuring the length of the wire, or of any test piece, before and after rupture, gives no real measure of actual extension after passing the minute range within the elastic limit. By the latter method the extension which actually occurs within a very short section of the specimen is credited to its whole length. Two wires of the same material but of unequal length are therefore credited with different degrees of ductility, although the amount is actually the same, and although the extension takes place within the same inch, or fraction of an inch in length on each.

The resilience as given here, is obtained

TEST OF WIRES FROM CABLES OF THE FAIRMOUNT SUSPENSION BRIDGE, PHILADELPHIA, PA.  
(Taken down in 1874—in use 32 years.)  
Made January 19th, 1875.

No.	DIAMETER.		AREA.		BREAKING WEIGHT PER SQUARE INCH.			REDUCED AREA.	MODULUS OF EXTENSION.†	RESILIENCE.‡
	Original.	Fractured.	Original.	Fractured.	On orig. Area.	On frac. Area.	Actual.			
1.....	0.122	0.089	0.0117	0.0062	94 871	179 032	1110	0.53	0.887	56 103
2*.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
3.....	0.123	0.09	0.0119	0.0064	87 395	162 500	1040	0.538	0.859	50 048
4.....	0.124	0.097	0.0121	0.0074	89 256	145 946	1080	0.612	0.635	37 765
5.....	0.125	0.1	0.0123	0.0079	88 618	137 974	1090	0.642	0.557	32 907
6.....	0.122	0.09	0.0117	0.0064	92 308	168 750	1080	0.547	0.828	50 054
7.....	0.124	0.093	0.0121	0.0071	91 735	156 338	1110	0.587	0.704	43 654
8.....	0.124	0.09	0.0121	0.0064	90 082	170 313	1090	0.529	0.801	53 568
9.....	0.122	0.09	0.0117	0.0064	92 308	168 750	1080	0.547	0.828	50 054
10.....	0.124	0.09	0.0121	0.0064	91 735	173 437	1110	0.529	0.801	54 490
11.....	0.124	0.09	0.0121	0.0064	86 776	164 063	1050	0.529	0.801	51 744
12.....	0.125	0.094	0.0123	0.0069	87 805	156 522	1080	0.561	0.782	45 776
13.....	0.124	0.094	0.0121	0.0069	86 776	152 174	1050	0.57	0.753	43 561
Means....	0.1236	0.09225	0.01202	0.006733	89 981	161 320	1080.9	0.5607	0.7922	47 575

\* Broken at a place where the wire had been struck by a hammer.

† Extension taken as proportional to reduction of section.  
‡ Resilience is two-thirds the product of tenacity by extension.

by multiplying this extension by two-thirds the maximum resistance. It measures the relative power of resisting shock.

An ordinary value, as taken from the record book of the Mechanical Laboratory where the tests were made, is about 20 000 for good bar iron. A very high value for bar iron is 30 000; the mean of these tests of wire is 47 575, which is excellent even for wire.

It is concluded that in this case, and aside from injury by corrosion, time had no unfavorable effect upon suspension cables.

The strength of the metal is almost precisely the same as that of new wire of similar size lately sent to the Laboratory by good

makers, and the ductility of the old wire is the greater.

The latter fact seems to indicate either that this wire was originally better than can generally be obtained in the market now, or that the long period of strain has somewhat improved it by increasing the tenacity of what the ductility shown, indicates was a rather soft wire.

The following are examples given for comparison, they are of a harder iron; the extensions were measured in the ordinary way, and properly represent the extension at the elastic limit. The real ductility of the material was somewhat less than that of wires given in the table.

ORDINARY DIAMETER.	DIAMETER AFTER FRACTURE.	BREAKING WEIGHT.	TENACITY.	EXTENSION.
INCHES.	INCHES.	POUNDS.	POUNDS PER SQUARE INCH.	
0.134	0.133	1 310	92 890	About 0.08
0.1205	0.1185	963	84 442	
0.08	0.0795	474	94 299	
0.071	0.068	368	90 384	
0.0535	0.0532	238	105 871	
0.029	0.029	75	113 546	

## BOOK NOTES.

### DIAGRAMS FOR COMPUTING EARTHWORKS.\*

This is a novel and ingenious method of arriving at the number of cubic yards in excavations and embankments, based on the several formulæ which are commonly employed for this purpose, but substituting for the ordinary numerical tables, a set of diagrams, in which the quantities given and sought are read off by scale on several systems of intersecting lines, the exact value required in any particular case being determined by the intersection of the proper lines. The lines are horizontal, vertical and oblique, representing three variable quantities, any two of which being given, the third may be determined by simple inspection.

\* Methods for the Computation from Diagrams of preliminary and final Estimates of Railway Earthworks, with Diagrams; by Arthur M. Wellington, C. E. D. Appleton & Co., New York, 1875.

The formulæ employed are first modified by proper reductions so as to express the number of cubic yards contained in a solid, in terms of two linear dimensions of the end area (the length, base and side slopes of the solid being supposed constant), and the diagram being constructed accordingly, gives at once the number of cubic yards. The linear dimensions are taken directly from the field notes.

The only errors that can occur in the use of the diagrams will be due either to an imperfect construction of them, or to carelessness in reading them. The diagrams accompanying the text appear to be constructed with accuracy, and on a scale large enough to admit of ascertaining the desired quantities with sufficient precision. The lines are ruled closely enough to form the scale which is required, and intermediate values are easily interpolated by eye. Directions are given by

which a draftsman may construct diagrams adopted to cases other than those considered.

In addition to diagrams for ordinary cross-sections of railway work, there are given those for side hill work, triangular prisms, and irregular work generally; for prismoidal correction for correction of quantities on curves; for preliminary estimates, and for setting slope stakes. A chapter is devoted to office notes, suggesting systematic forms for keeping the earthwork records in connection with this method of determining quantities.

The subject is treated with clearness; the rules are simple and illustrated by examples. The work as a whole will form a valuable addition to the working library of the practical railway engineer.

The definition of a hyperbolic paraboloid (paragraph 34) is singularly erroneous and contradictory. The surface is described as generated by a right line "moving parallel with itself" (which would generate a plane) "along two other right lines not in the same plane," which is impossible if the first condition is maintained.

**CATECHISM OF THE LOCOMOTIVE.\*** This work gives, in language at once simple and exact, a review of all the more important points connected with the design and manage-

\* *Catechism of the Locomotive.* By M. N. Forney. Published by the *Railroad Gazette*, 73 Broadway, N. Y., 1875.

ment of the locomotive, the action of steam in the cylinders, the use of the steam-engine indicator, together with the general properties of steam, chemistry of construction, laws of friction and effect of lubricants. Each part of the locomotive is treated in detail, and illustrated by sketches reduced from working drawings. This is an important feature of the work, and in this respect it probably stands alone among elementary text books on technical subjects. Besides the figures illustrating details, there are a number of plates, accurately drawn to scale, representing prominent American locomotives, with notes in regard to dimensions and weight.

Great care has evidently been taken to give the most reliable data on the resistance of trains, properties of fuel, operating expenses, performance of locomotives, and similar practical details.

All calculations in the book are arithmetical, except that the signs of addition, subtraction, multiplication and equality are used for the purpose of abbreviating the examples. The reasoning is thus adapted to the comprehension of a very large class of readers, including mechanics, firemen and locomotive runners, for whom it is especially intended. It can be read, however, with profit by any one who is interested in the subjects of which it treats; and it will be a very useful work of reference for every engineer.

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— the Conveyance of — across navigable Streams, a Paper read before the Civil Engineers' Club of the Northwest, by E. S. Chesbrough. Chicago. 12mo.  
— Works, the Liverpool —. Charles H. Beloe. London. *E. & F. N. Spon (New York).* \$9.60.  
Well Digging, rudimentary Treatise on — — and Pump Work. John George Swindell. 6th ed., revised by G. R. Burnell. (Weale's Series.) London. 12mo. *Lockwood & Co.* 1s. 6d.  
Year Book, the Statesman's — —, a statistical and historical Annual of the States of the civilized World, and Handbook for Politicians and Merchants for 1875. F. Martin. (12th annual Publication.) Lond. 12mo. *MacMillan & Co. (New York).* \$3.50.

#### ADDITIONS TO

### LIBRARY AND MUSEUM.

NOTE.—Members and others are asked to contribute regularly to the library of the Society, copies of government, municipal, railway, canal and other reports, specifications, profiles, maps, photographs and like matter, making up the record of engineering operations for the past or present, and to inform the Secretary where such may be had. Duplicate copies are desired, for transmission to foreign societies in return for works collected and sent to this library by them; also for exchange with members and others who wish complete sets referring to particular subjects. In order to gather material now considered of but little value, but of great future importance in the history of the public works of this country and a comparison of their economical results, donations are solicited of old reports or pamphlets, which in any way refer to their construction or operation.

#### DONATIONS ARE ACKNOWLEDGED AS FOLLOWS :

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|---|---|
| From S. T. Abert, (also from Gen. A. A. Humphreys, Ch. of Eng., U. S. A.), Washington, D. C.:   | South Boston Flats, Argument of Edward Atkinson upon the Necessity of Connecting the — — with the Railway System of New England and the West. February, 1875. Boston. (2 copies.)   |
| Report in Reference to the Canal to connect the Chesapeake & Ohio Canal with the City of Baltimore. By Col. J. J. Abert, Chf. of Corps Top. Eng., U. S. A. 1838. (Reprint.) Washington, 1874. (2 copies.) | From Phineas Ball, Springfield, Mass: Report of the Board of Water Commissioners of the City of Springfield to the Common Council, 1875. Springfield.   |
| From the American Institute of Mining Engineers, Easton, Pa.:   | From the Boston Society of Civil Engineers, Boston, Mass.:  |
| Transactions of the American Institute of Mining Engineers. Vol. II. May, 1873, to February, 1874. Easton, Pa., 1874.   | By-Laws of Boston Society of Civil Engineers. Newton, 1875.   |
| From Edward Atkinson, Boston, Mass.:  | From John D. Brandt, Washington, D. C.:   |
| Hoosac Tunnel, how to pay for — — by Fixing the Terminus of the Tunnel Line on the South Boston Flats, belonging to the Commonwealth. Edward Atkinson. Boston, 1873.                                      | Bronze ; Essay on the various Alloys, especially of Phosphorous Bronze, for the Founding of Cannon. By C. Montefiore, M. Levy and C. Kinkel. Brussels, 1870. Translated from the French by John D. Brandt, Chief Clerk Bureau of Ordnance, Navy Department. Washington, 1872. |
| South Boston Flats. Report of the Committee appointed in Relation to the Use of the Commonwealth Flats at South Boston. January, 1875. Boston. (2 copies.)  |   |

From the Civil Engineers' Club of the Northwest, Chicago, Ill.:

Conveyance of Water across navigable Streams—a Paper read before the Club, October 20, 1873, by E. S. Cheebrough. (2 copies.)

Deep Pile Driving in Wisconsin; a Paper read before the Club, February 2d, 1875, by C. W. Durham. (2 copies.)

From H. Wadsworth Clarke, Syracuse, N. Y.:

Canals; Laws of the State of New York in Relation to the Erie and Champlain Canals, together with annual Reports of the Canal Commissioners, and other Documents; also Maps of these Canals, showing their Route, etc., etc. Vols. 1 & 2. Albany. 1825.  
Onondaga Salt Springs. Annual Report of the Superintendent of—transmitted to the Legislature, January 19, 1875. Albany.

From E. F. Falconnet, Louisville, Ky. :  
Cumberland & Ohio R. R., Fourth annual Report of—for year ending April 30, 1874. Louisville.

Tennessee & Pacific R. R. Co., First annual Report of—January 1, 1871. Nashville.

From John T. Fanning, Manchester, N. H. :  
Manchester Water Works; Third annual Report of the Board of Water Commissioners and of the Engineer. Manchester, 1875.

From Estevan A. Fuertes, Ithaca, N. Y. :  
Cornell University Register and Catalogue. 1874-5. 2d ed. Ithaca.

From F. De Funiak, Louisville, Ky. :  
Rules and Instructions for the Government of Trackmen of the Louisville, & Nashville and South & North Alabama Railroads. Louisville, 1875. (2 copies.)

From Clemens Herschel, Boston, Mass.,  
Continuous revolving Drawbridges, the Principles of their Construction, and the Calculation of the Strains in Them. Clemens Herschel. Boston, 1875.

From Gen. A. A. Humphreys, Chief of Engineers, U. S. A., Washington, D. C.:

Geographical and geological Explorations and Surveys west of the 100th Meridian, in 1872. Progress Report on—By Lieut. George M. Wheeler, Corps of Eng., U. S. A. Washington. 1874.

Preliminary Report upon invertebrate Fossils, collected by the Expeditions of 1871, 1872, and 1873, with Descriptions of new Species. C. A. White, M. D. Washington. 1874.

From the Institution of Civil Engineers: London, Eng.:

Minutes of Proceedings of the Institution of Civil Engineers; with other selected and abstracted Papers. Vol. XXXIX. Session 1874-75. Part I. London, 1875.

From the Institution of Mechanical Engineers, Birmingham, Eng. :  
Institution of Mechanical Engineers, Proceedings, August, 1874. Cardiff Meeting, Part II. Birmingham.

From H. McKay, Greenpoint, N. Y. :  
Speech of Peter Cooper at the N. Y. Cheap Transportation Company's Dinner. 1875. (5 copies.)

Steam on the Canals; Report made to Hon. Peter Cooper, by Hugh McKay, Superintendent, New York. 1875. (5 copies.)

From Richard P. Morgan, Jr., Bloomington, Ill.:

Rapid Transit; Review of the Report of the Committee of the American Society of Civil Engineers, on Rapid Transit. By Richard P. Morgan, Jr., C. E., and Letter of Julius W. Adams, C. E. New York, 1875. (Copies for distribution.)

From E. Pontzen, Vienna, Austria:

Notes of technical Travel in America—Lecture delivered Nov. 14, 1874, by Ernest Pontzen, C. E. Excerpt from Proc. of Austrian Society of Engineers and Architects. (German.)

From W. Milnor Roberts, New York:  
Letter from the Secretary of War relative to the Act of June 23, 1874, for the Purpose of Making a Survey of the Mouth of the Mississippi River. (3 copies.)

From William Rotch, Fall River, Mass. :  
Fall River Water Works; Report of the Watuppa Water Board to the City Council, January 1, 1875. Fall River. (3 copies.)

From Theron Skeel, New York :  
Methods of testing Steam Engines; with a Description of Trials of Blake's Patent circulating Pumps on the U. S. S. Tennessee. By George P. Hunt, U. S. N., and Theron Skeel, New York. 1874.

From Lieut. George M. Wheeler, Corps of Eng., U. S. A., Washington, D. C.:

Annual Report upon the geographical Explorations and Surveys West of the 100th Meridian, in California, Nevada, Utah, Arizona, Colorado, New Mexico, Wyoming and Montana, by Lieut. Geo. M. Wheeler, Corps of Eng., U. S. A. Washington, 1874.

Report upon geographical and geological Explorations and Surveys west of the 100th Meridian, in 1872, by Lieut. George M. Wheeler, Corps of Eng., U. S. A. Washington, 1874.

And relating to same—

Catalogue of Plants collected in 1871, 1872 and 1873, with Descriptions of new Species. Washington, 1874.

Geological Maps, illustrating geographical Surveys west of the 100th Meridian.

Preliminary Report upon invertebrate Fossils, collected by the Expeditions of 1871, 1872 and 1873, with Descriptions of new Species. C. A. White, M. D. Washington, 1874.

Report upon ornithological Specimens collected in 1871, 1872 and 1873. Washington. 1874.

From Miscellaneous Sources :

Brooklyn Collegiate and Polytechnic Institute, 19th annual Catalogue of—New York, 1874.

Maritime Ports of France. Vol. 1. Paris. 1874. Accompanied by Atlas of 13 Sheets of Maps. (French.)

Specifications and Drawings of Patents issued from the U. S. Patent Office for July, 1874. Washington.

Report of the Board of Water Commissioners to the Rochester Common Council, January 1st, 1875. Rochester.

## ANNOUNCEMENTS.

**MEETINGS.**—The next *evening* meeting of the Society will be held Wednesday, April 21st, at 8 o'clock, when the discussion on "Rapid Transit and Terminal Freight Facilities,"\* begun at the meeting on April 7th, will be continued and other matters presented.

The next stated meeting of the Board of Direction will be held Monday, May 3d, at 2 o'clock P. M., for the transaction of regular business.

The next *afternoon* meeting of the Society will be held Wednesday, May 5th, at 1 o'clock, when ballots for members will be canvassed, plans for the Seventh Annual Convention considered, and other business taken up.

THE SEVENTH ANNUAL CONVENTION of the Society will be held at Pittsburgh, Pa., on Tuesday, Wednesday and Thursday, June 8th, 9th, and 10th next.

Sessions for the consideration of professional subjects will be held from 9½ o'clock A. M. to 1½ P. M. each day, and one for the transaction of such regular business as may be brought up—at 7½ o'clock, on Tuesday; the Convention Dinner will be at 7½ o'clock P. M. on Wednesday, and the remaining available time devoted to semi-professional excursions and meetings for social intercourse.

Papers for the Convention may be announced by title, but none requiring more than ten minutes' time are to be read. Topics for consideration are to be selected from papers of the Society printed during the preceding year. The order of proceedings will be announced in May Transactions.

Members desiring to offer papers, or to discuss topics, should give notice to the Secretary by May 1st, and before if practicable.

**TESTS OF IRON AND STEEL.**—The following is an order of the President of the United States.†

Executive Mansion, March 25, 1875.

In pursuance of the 4th section of the act entitled "An act making appropriations for sundry civil expenses of the Government for the fiscal year ending June 30, 1876, and for other purposes," approved March 3, 1875, a Board is hereby appointed, to consist of—

Lieutenant-Colonel T. T. S. Laidley, Ord-

nance Department U. S. Army, President of the Board;

Commander L. A. Beardslee, U. S. Navy;

Lieutenant-Colonel Q. A. Gillmore,\* Engineer Department U. S. Army;

David Smith, Chief Engineer, U. S. Navy;

W. Sooy Smith,\* Civil Engineer;

Alexander L. Holley,\* Civil Engineer;

R. H. Thurston,\* Civil Engineer;

who will convene at the Watertown Arsenal, Massachusetts, on April 15, 1875, or as soon thereafter as practicable, for the purpose of determining, by actual tests, the strength and value of all kinds of iron, steel and other metals which may be submitted to them, or by them procured, and to prepare tables which will exhibit the strength and value of said materials for constructive and mechanical purposes, and to provide for the building of a suitable machine for establishing such tests, the machine to be set up and maintained at the Watertown Arsenal.

The funds appropriated for the purposes of these tests will be disbursed under the Ordnance Department of the Army, and the Board will receive instructions from, and make its report to, the Chief of Ordnance.

Mr. R. H. Thurston, Civil Engineer, is designated as Secretary of the Board at an annual compensation of twelve hundred dollars.

Actual traveling expenses, as provided by law, will be allowed the members of the Board.

U. S. GRANT.

**STRENGTH OF STONE AND BRICKS.**—At the meeting of the Society, April 7th, a request was presented, that members who could do so, furnish samples of stone and bricks for tests as to compressive strength and other characteristics indicative of value for construction purposes. Of such samples—from each quarry of stone there should be, if possible, one piece 4 inches cube with one rock face, and three pieces 2 inches cube; or, instead, there may be one block one cubic foot, (which, if well squared, is preferred): of bricks, there should be at least two of each kind.

These may be sent to the care of the Secretary, who will pay express charges thereon. Reports of the tests will be published in due course, and also furnished to those who contribute samples.

\* Members of the Society.

\* Transactions, Vol. IV, page 1-50.

† General Orders, No. 46, War Department, March 27th, 1875.      ‡ Page 209.

VOLUME III OF TRANSACTIONS ended with No. CV. A List of Contents is enclosed herewith, and an Index will appear with May Transactions. It is intended that the two parts of this publication shall be bound separately; with this view the paging of the two—"Transactions" and "Proceedings"—is distinct. In due course, when a sufficient number of pages of the latter is printed, the volume will be closed and indexed also.

THE NUMBER OF PAGES IN TRANSACTIONS (as before announced) varies in the several issues, on account of the difference in length of the papers contained. In each, during the past quarter the number has been in excess, hence this issue contains but 30 pages.

A LIST OF MEMBERS of the Society, with their addresses, was issued on March 30th. The types will be kept standing; members are requested to inform the Secretary of errors noted, that corrections may be made as below, and in subsequent editions.

ADDRESSES ARE WANTED by the Secretary, as follows :

Blackwell, Edward R., late of Norristown, Pa.

Emerson, George D., late of 13 East Thirty-third Street, New York.

Stahlberg, Albert J., late of Merced, Cal.

CARD TO MEMBERS.—The following is from a circular issued December 10th, 1872.

"The Society should be of real and positive benefit to each member; that this in one way may result, the Secretary will endeavor to obtain experimental knowledge from experienced members, upon matters of practice, for those who request it; examine in the public libraries, authorities upon special topics; select books, instruments, and similar 'material' for an engineer's equipment, and to execute other commissions within his province, of a professional character. Those seeking engagement and those requiring engineering service are desired to communicate to him the particulars, that such may be brought together; and generally, all interested are urged to aid in rendering the offices of the Society a bureau of professional information to its members."

Members thus commanding the Secretary are requested to state explicitly what is required, and he will endeavor to execute their commissions with reasonable promptitude, *without charge*.

## LIST OF MEMBERS.

### CORRECTIONS.

- BACOT, ROBERT C. .... Ch. Eng. N. J. State Riparian Commission, 31 Montgomery St., Jersey City, N. J.  
 BISSELL, H. .... (Care C. W. & M. Ry.) Wabash, Ind.  
 CLARK, H. WADSWORTH. .. 11 Granger Block, Syracuse, N. Y.  
 COLEMAN, ISAAC D. .... (Late of 11 Park Place, New York).  
 Died April 8th, 1875.  
 CORTHELL, ELMER L. .... Ch. Eng. Miss. River Bridge Co., Louisiana, Mo.  
 DU BARRY, JOSEPH N. .... 424 Eutaw Place, Baltimore, Md.  
 FORD, ARTHUR L. (A.) .... Olcott, N. Y.  
 GOODWIN, JOHN M. .... Chamberlain's Building, Cleveland, O.  
 HUNTINGTON, COLLIS P. .... Vice Pres. C. P. R. R., 9 Nassau St., New York.  
 MITANDER, NILS. .... 69 William Street, New York.  
 WHITCOMB, HENRY D. .... Eng. James River Improvement, Richmond, Va.  
 WURTELE, ARTHUR, S. C. .... Niagara Bridge Works, Buffalo, N. Y.  
 YARDLEY, EDMUND. .... 145 Duane Street, New York.

# AMERICAN SOCIETY OF CIVIL ENGINEERS.

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## PROCEEDINGS.

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### MINUTES OF MEETINGS.

(Abstract of such as may be of general interest to members.)

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#### OF THE SOCIETY.

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APRIL 21ST, 1875.—A stated meeting was held at 8 o'clock P. M.

The members present engaged in an informal discussion of professional matters; the remainder of the evening was spent in social intercourse.

MAY 5TH, 1875.—The new rooms of the Society not being ready for use, the regular meeting was adjourned for one week.

MAY 12TH, 1875.—An adjourned regular meeting of the Society was held at 2 o'clock P. M.

The votes on admission to membership were canvassed, and the following declared elected—Members, Messrs. Francis W. Bacon, of Boston, Mass.; Robert Forsyth, of Chicago, Ill., and William H. Paine, of Brooklyn, N. Y.; and Juniors, Messrs. George H. Baxter, of New York; John C. Bland, of Philadelphia; George A. Kimball, of Somerville, Mass.; Mansfield Merriman, of New Haven, Conn., John G. Speed, of Louisville, Ky., and Henry W. Stuckle, of New York.

Reports from committees were presented, ordered printed, and set down for discussion at the Seventh Annual Convention as follows: on "Tests of American Iron and Steel," by Gen. William Sooy Smith, Chairman; on the "Form, Weight, Manufacture and Life of Rails," by Ashbel Welch, C. E. Chairman; on "Founding an Engineering Library and Museum," by G. Leverich, C. E., Secretary; on "Statistics of the Cost and Work of Pumping Engines," by Gorham P. Low, Jr., C. E., W.



Milnor Roberts, C. E. and John Bogart, C. E., Committee, and on "Railway Signals," by J. Dutton Steele, C. E., Chairman.

On recommendation of the Board of Direction, the hour of the regular meetings of the Society was changed from 1 to 8 o'clock P. M.

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### OF THE BOARD OF DIRECTION.

MAY 3D, 1875.—The new rooms of the Society not being ready for use, the stated meeting was adjourned for one week.

MAY 10TH 1875.—An adjourned stated meeting was held at 2½ o'clock P. M.

Proposals for admission to the Society, and the investment of its funds were considered; rules for the issue of certificates of membership were adopted; the semi-annual report of the Treasurer was presented; invitations to the Society for the entertainment of members attending the Seventh Annual Convention were accepted; it was recommended that the hour of regular meetings of the Society be changed from 1 to 8 o'clock P. M.; and the first Wednesday of the month, at 4 o'clock P. M., was made the time of stated meetings of the Board.

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## REPORTS OF COMMITTEES.

### ON TESTS OF AMERICAN IRON AND STEEL.

PRESENTED MAY 3D, 1875.\*

*To the American Society of Civil Engineers:*

The Committee on Tests of American Iron and Steel begs leave to submit the following report:

Owing to the difficulty in securing concert of action on the part of its members, who were widely separated and very actively engaged, it was not until late in January that the Committee, accompanied by several distinguished members, and by the Secretary, of the Society (who also kindly served as Secretary to the Committee), visited Washington and appeared before the House Committee on Appropriations, to explain the value and importance of a thorough set of tests of American iron, steel and other metals used

in construction. This we were enabled to do without delay, in accordance with an appointment previously made by our Secretary with the Committee on Appropriations.

A bill making an appropriation of \$20,000 for tests of American iron and steel, had been introduced, passed its various readings, and been referred to the Committee on Appropriations. Those who had this bill in charge, very courteously consented that we might modify it as we liked to cover our larger object, and thus save much valuable time. In this way a hearing was had at once. The object was briefly explained to the Committee on Appropriations, the members of which grasped it with a ready and thorough comprehension, unexpected by us from gentlemen who were not professional engineers. This Committee courteously inserted into the Act making Appropriations for the Sundry Civil

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\* At the meeting of the Society, May 12th, ordered printed for consideration at the Seventh Annual Convention.

Expenses of the Government, a section fully covering the object in view.

Some amendments affecting this portion of the bill were offered in the House, and one to strike out the clause entirely was offered in the Senate; but all these were promptly voted down and the bill, including the section referred to, (Section 4, heretofore printed in Proceedings of the Society\*), passed, and was approved March 3d, 1875.

In accordance therewith, the President of the United States, per General Order, No. 46,† appointed a Board consisting of—

Lt. Col. T. T. S. Laidley, Ordnance Department, U. S. A., *President*.

Comd. L. A. Beardslee, U. S. N.

Lt. Col. Q. A. Gilmore, Engineer Department, U. S. A.

David Smith, Chief Engineer, U. S. N.

W. Sooy Smith, C. E.

Alexander L. Holley, C. E., and

R. H. Thurston, C. E., *Secretary*.

The Board was ordered to convene at Watertown Arsenal, Mass., April 15th, and instructed to determine by actual tests, the strength and value of all kinds of iron, steel and other metals which may be submitted to it, or by it procured, and to prepare tables which will exhibit the strength and value of said materials for constructive purposes.

It met according to the order, and at once entered upon its duties. Lines of investigation and experiment were determined on, and Standing Committees appointed as follows:

(A) ON ABRASION AND WEAR:—To examine and report upon the abrasion and wear of railway wheels, axles, rails and other materials, under the conditions of actual use. R. H. Thurston, A. L. Holly and D. Smith.

(B) ON ARMOR PLATE:—To make tests of armor plate, and to collect data derived from experiments already made, to determine the characteristics of metal suitable for such use. Q. A. Gilmore, A. L. Holly and R. H. Thurston.

(C) ON CHEMICAL RESEARCH:—To plan and conduct investigations of the mutual relations of the chemical and mechanical properties of metals. A. L. Holly and R. H. Thurston.

(D) ON CHAINS AND WIRE ROPES:—To determine the character of iron best adapted for chain cables, the best form and proportions of link, and the qualities of metal used in the manufacture of iron and steel wire rope. L. A. Beardslee, Q. A. Gilmore and D. Smith.

(E) ON CORROSION OF METALS:—To investigate the subject of the corrosion of metals under the conditions of actual use. W. Sooy Smith, Q. A. Gilmore and L. A. Beardslee.

(F) ON THE EFFECTS OF TEMPERATURE:—To investigate the effects of variations of temperature upon the strength and other qualities of iron, steel and other metals. R. H. Thurston, Q. A. Gilmore and L. A. Beardslee.

(G) ON GIRDERS AND COLUMNS:—To arrange and conduct experiments to determine the laws of resistance of beams, girders and columns, to change of form and to fracture. W. Sooy Smith, Q. A. Gilmore and D. Smith.

(H) ON MALLEABLE IRON:—To examine and report upon the mechanical and physical proportions of wrought-iron. L. A. Beardslee, W. Sooy Smith and A. L. Holly.

(I) ON CAST-IRON:—To consider and report upon the mechanical and physical properties of cast iron. Q. A. Gilmore, R. H. Thurston and D. Smith.

(J) ON METALLIC ALLOYS:—To assume charge of a series of experiments on the characteristics of alloys, and an investigation of the laws of combination. R. H. Thurston, L. A. Beardslee and D. Smith.

(K) ON SIMULTANEOUS ORTHOGONAL STRAINS:—To plan and conduct a series of experiments on simultaneous orthogonal strains, with a view to the determination of laws. W. Sooy Smith, L. A. Beardslee and R. H. Thurston.

(L) ON PHYSICAL PHENOMENA:—To make a special investigation of the physical phenomena accompanying the distortion and rupture of materials. W. Sooy Smith, A. L. Holly and R. H. Thurston.

(M) ON RE-HEATING AND RE-ROLLING:—To observe and to experiment upon the effects of re-heating, re-rolling or otherwise re-working; of hammering as compared with rolling, and of annealing the metals. L. A. Beardslee, D. Smith and W. Sooy Smith.

(N) ON STEELS PRODUCED BY MODERN PROCESSES:—To investigate the constitution and characteristics of steels made by the Bessemer, open hearth, and other modern methods. A. L. Holly, D. Smith and W. Sooy Smith.

(O) ON STEELS FOR TOOLS:—To determine the constitution and characteristics, and the special adaptations of steels used for tools. D. Smith, L. A. Beardslee and W. Sooy Smith.

The above named Committees of this Board were appointed to conduct the several investi-

\* Page 203. † Page 219.

gations, and the special researches assigned them in the interval during which the regular work of the Board is delayed by the preparation of the necessary testing machinery, and during such periods of leisure as may afterward occur.

These investigations are expected to be made with critical and scientific accuracy, and will, therefore, consist in the minute analysis of a somewhat limited number of specimens and the precise determination of mechanical and physical properties, with a view to the detection and enunciation of the laws connecting them with the phenomena of resistance to flexure, distortion and rupture.

The Board will be prepared to enter upon a more general investigation, testing such specimens as may be forwarded to the President of the Board, or such as it may be determined to purchase in open market, immediately upon the completion of the apparatus ordered, at which time circulars will be published, giving detailed instructions relative to the preparation of specimens for test, and stating minutely the information which will be demanded previous to their acceptance.

The Board, as a whole, is a Committee to collect the results of tests, experiments and investigations already made, which are found to be accurate and reliable.

The Board has advertised for the construction of a testing machine, having a maximum capacity of 800 000 pounds, suitable and convenient in all respects to subject specimens up to 30 feet long and 2½ feet wide, to either tension or compression, and capable of accurately measuring the strains imposed. It is proposed that this machine shall, at an early date, be exchanged for one of 2 000 000

pounds capacity; the object being to test pieces of the size and under the conditions of actual use.

Thus, is indicated in part, the nature of the work which the Board purposes to do, and this Committee would here bespeak the earnest aid of the entire Society and profession of Civil Engineers in the accomplishment of the work above outlined. Any suggestions which members may make as to exact methods of conducting tests, or practical directions the inquiry should take, will receive proper acknowledgment and consideration.

This is, undoubtedly, the most important investigation ever undertaken by our government, in its relation to the industrial interests of the country. It had its birth in the American Society of Civil Engineers, and as its own child should be fostered and helped. Large appropriations of money will be needed from year to year, and so long as the work of the Board is carried forward in the spirit in which it was conceived, it is hoped that each member will exert his influence to secure the means required. To this end, this Committee would ask that it be continued, or a new Committee appointed, to represent the Society before the Government in the matter of these tests and investigations.

The Committee tenders its thanks to the Secretary of the Society for his zealous and efficient aid, and to each member for the assistance he may have rendered in getting the Government to undertake this great work on a scale commensurate with its importance.

Respectfully submitted for the Committee,

WM. SOOT SMITH,  
Chairman.

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#### ON FOUNDING

### AN ENGINEERING LIBRARY AND MUSEUM.

PRESENTED APRIL 25TH, 1875.\*

At a regular meeting of the Society held July 2d, 1873, the following was presented:

"As set forth in the Constitution; two of the objects of the American Society of Civil Engineers are: the professional improvement of its members, and the advancement of engineering in all its branches."

"Among the means whereby these objects

are to be secured, are: the collection and dissemination of current professional knowledge, and the foundation of a library and museum."

"The professional improvement of members comprehends the collection and distribution among them of all experimental knowledge relating to their profession, both of the past, finished and recorded, and of the present, incomplete and unwritten. This includes the discussion of theory, the results

\* At the meeting of the Society, May 12th, ordered printed, for consideration at the Seventh Annual Convention.

of practice, the accounts of success and failure, the teachings of experiment and the examination of data, and thus will largely promote the advancement of engineering in all its branches."

"At best the purpose of the Society will be but partially effected by the collection and dissemination of current professional knowledge, unless the same is also securely preserved; this involves the foundation of a library and museum."

"The library of the American Society of Civil Engineers should contain all that has been published relating to the history and prosecution of engineering, maps and profiles of every canal and railroad, their complete reports, those of the several municipal, state and federal departments, and select published matter referring to other and miscellaneous works, public and private. It should also contain standard works of reference in science and art and indeed lack nothing required of a library by the student or accomplished engineer seeking professional knowledge. The museum should be an adjunct of the library and illustrate in matter much that is there described in words; efficiently representing by models and samples, the proportions, form and physical characteristics of the agents of engineering effort."

"Much professional knowledge is recorded in the several technical journals of the day, and this is almost inaccessible to the busy members of a profession which allows but little time or opportunity for exhaustive reading. Complete treatises are published from time to time, upon theoretical or practical subjects, full of matter valuable to engineers who are unable to possess or peruse them. These, as issued, should form a part of the library of the Society and be made available to members."

"The advantages of such a library should be placed at the command of all connected therewith, wherever they may happen to reside, so that on request, complete examinations upon specified topics could be made, pertinent extracts copied and proper references given; therefore—"

"Whereas, the foundation of a library and museum, which contains within itself all accessible published matter relating to the history, theory and practice of engineering, the construction and management of public improvements, and the methods and cost of manufacturing operations, with illustrations by models and samples of the results thereby obtained, must be invaluable, not only to the profession, but to all who are interested in the pursuit or the application of practical knowledge—"

"Resolved, that a Committee, consisting of the President and nine other members to be named by him, with power to fill vacancies, be appointed to devise a plan whereby such a library and museum may be founded; the funds obtained for its collection, management, increase and maintenance; a suitable place secured, where it and other possessions of the Society may be preserved and its advantages enjoyed by members and others connected therewith, irrespective of their location; the Committee to report to this Society before October 1st, next; the report to be printed and distributed to members for examination and approval, and action thereon made a special order for the Annual Meeting to be held November 5th, 1873."

The resolution was adopted and a Committee appointed consisting of Messrs. Horatio Allen,\* of South Orange; Julius W. Adams, of Brooklyn; E. S. Chesbrough, of Chicago; Alfred P. Boller, of New York; Thomas C. Clarke, of Philadelphia; James O. Morse, of New York; Charles Herman, of Louisville; G. Leverich, of New York; Charles Paine, of Cleveland, and Theodore G. Ellis, of Hartford.

At a meeting of the Committee for organization, held August 30th following, the mover of the above resolution was requested to prepare a report on the founding, maintenance and use of an engineering library and museum, and to present it to the several members for individual criticism and revision, that an interchange and comparison of views could be had without the difficulty of bringing the Committee together.

A general financial embarrassment in the business and commercial world, occurred soon after; this and other causes prevented further action under the resolution. Meanwhile the Society has grown and strengthened, its needs and opportunities for the collection and dissemination of professional knowledge are greater now than ever before; whence it seems proper not to longer delay the presentation of a scheme for the establishment of a library and museum, that such action may be taken as may seem wise and proper.

With this view what follows was, in due course, submitted to the members of the Committee for correction, addition or comment.

The library of the American Society of Civil Engineers should contain the literature of rational and applied science, constructive art and technology; all that has been, or may from time to time be published, relating to the history and prosecution of engineering; the maps and profiles of every canal and railroad, their complete reports, and

\* Resigned in October, 1873.

those of municipal and state departments; descriptions of private and miscellaneous works; statistics of the material resources and development, the wealth, manufactures and commerce of countries; standard works of reference in science and art, and lack nothing published anywhere, in our own or other tongue, that in a library may aid the student or accomplished engineer seeking professional knowledge.

As set forth in the preamble, the museum should be an adjunct of the library and illustrate in materials much that is there described in words; efficiently representing by models and samples, the proportions, form and physical characteristics of the agents employed in engineering effort.

Such a library is, and for a long time must be, more or less ideal; perfect and complete work of this character, only results from the united and continued effort of a class or a profession, for many years. On this continent there exists scarcely the beginning of such an undertaking, and abroad, the Institution of Civil Engineers in London possesses the only English engineering library, complete in the literature of any special professional topic. Here, in some private collections, are series of reports of public improvements, more complete than to be found today in the offices of these works. On the shelves of this Society are valuable railroad reports not possessed by the companies themselves, or to be had in the usual channels of the book trade. The Departments at Washington send to the Boston Public Library to consult their own reports, which they have not preserved and cannot find elsewhere, from the lack of a system operating from year to year, whereby what at the time can be had for the asking, is collected and preserved until age and rareness gives it value.

Referring again to the preamble—much professional knowledge recorded in the several technical journals of the day, is almost inaccessible to the busy members of a profession which allows but little time or opportunity for exhaustive reading. Complete treatises on theoretical or practical subjects, frequently published and full of matter valuable to engineers, are neither purchased or read by them. These as issued, should form a part of the library, and its advantages be placed at the command of all connected therewith, wherever they may happen to reside, so that at their request, complete examinations on specified topics can be made, pertinent extracts copied, and proper references given.

The plan here outlined involves the preparation of concise abstracts of new works, re-

ports, scientific and technical journals, proceedings of societies, and other publications, as received; the whole to be classified and indexed, that a busy man may quickly learn, without the trouble and expense of looking over the vast amount of matter now published, to determine for himself, whether there has recently appeared in print anything referring to a particular subject. A serial index of current engineering and technical literature as thus described, can be comprised within a few pages issued weekly or monthly, and would largely facilitate the dissemination of professional knowledge "among men of practical science."

A skillful librarian, who knows what the library contains, and where it is to be found, can at the mere cost of the time spent, make exhaustive researches on a topic, for members, quicker and with greater thoroughness than they themselves can do it. Any one who has consulted large libraries knows that, generally, more time is spent in learning how and where to look, than in the work at hand.

In these times of cheap and rapid expressage, duplicate volumes may be loaned to a non-resident member, and at small risk and cost, sent to him, no matter how remote his residence is.<sup>2</sup>

Thus is set forth a plan whereby a complete engineering library, rich and full in every particular, may be within the easy reach of any member, and its varied advantages enjoyed, at a less expenditure of time and means than if it were all his and in his office.

Like all vital and permanent undertakings, this must have a beginning, perhaps a small one; but if it has life and vigor, with wise nurture and providing care, there will be a steady growth towards completeness and perfection.

It is therefore proper to enquire what it will cost to begin and maintain such a library, by this Society.

Of standard works, books of reference and the like, required in a well selected collection of engineering and technical literature—bearing in mind that all but historical and descriptive works of this character, are frequently superseded by others of a later date, and hence the number of valuable books of this class is not large—it is estimated that 5 000 volumes will comprise most that is needed, and cost including shelving, not to exceed \$24 000. During the year ending June 30th last, the whole number of volumes in English, French and German, published

<sup>1</sup> See views of Mr. T. C. Clarke, page 228.

<sup>2</sup> See views of Mr. C. Hermany, page 228.

and for sale, which should have a place in a library like this, was less than 500, costing about \$1 500, and during the preceding year the number and cost were less.

The various weekly and other journals, which record the operations and progress of constructive art, and the publications of scientific and professional associations, are not comprised in this. They may be had at the cost of postage, in exchange for the Transactions of the Society. Nor, is included that large, constant and valuable issue of books technically called "Reports," for the receipt of which, in regular course and often in duplicate, arrangements can be made by members located at various points, with the managers of public works and with municipal and State authorities, and for foreign countries through the Smithsonian Institution or the Department of State at Washington.

Models and specimens are rarely on sale or to be purchased; usually members and others interested will contribute them.

Assuming that 5 000 volumes are added at once to the library now possessed by the Society, and that by purchase and otherwise 1,000 more are acquired yearly; commodious rooms therefore, in a structure practically fire proof and eligibly located, can be had for the first ten years, at an annual rental of \$2 750, perhaps for less. The furniture for such, exclusive of shelving, may be set down at \$1 000, and to make examinations, prepare abstracts and compile the Serial Index of Engineering and Technical Literature, as described above, and to take general care of the library, will involve for clerical services an additional yearly outlay estimated at \$2 000. The remaining annual expenses will be for shelving, as new books are received, binding, express charges, postage, insurance and incidentals, which are put down at \$750.

Collecting these figures, this library would therefore require an immediate outlay of—

For standard books.....	\$24 000
Furniture of rooms.....	1 000
Amounting to.....	\$25 000
And an annual expenditure for—	
New books.....	\$1 500
Rent of rooms.....	2 750
Clerical assistance.....	2 000
Shelving, binding, &c.....	750
Amounting to.....	\$7,000
Which is a seven per cent. income on..	\$100 000
Whence total cost of endowment would be.....	\$125 000

<sup>a</sup> See views of Mr. T. C. Clarke, page 228.

This will found and maintain the library, leaving what sums may be received from members and others, annually or occasionally for its use, to be applied to different purposes. But as outlined, such an undertaking will earn considerable revenue; enough should be received for the "Index," the examinations and copies, and the use of the library by those not members of the Society, to materially reduce the annual expenditure; if \$3 500, then the endowment required would be but \$75 000. In case the whole amount required is not promptly obtained, purchases of standard and new books may be made, and the use of the library by non-resident members inaugurated as soon as enough has been contributed to defray the necessary expenses; the system may be expanded as more money is paid in.

It is thought that a sufficient sum for the purpose in view may be raised by a judicious appeal to capitalists and corporations, whose wealth and income, largely due to engineering progress, is still contingent upon it, and to patriotic, public spirited men who desire the growth of knowledge, and to increase their country's greatness by facilitating the development of her material resources.

Subscriptions may be solicited in shares of \$500, and for each, the donor be allowed to name a person who shall enjoy the privileges of the library and have a voice in its management, the same as if he were a member of the Society.<sup>5</sup> Thus a railway company, for a \$1 000 subscription, could designate its Chief Engineer and its Superintendent, or other two officials. When the whole endowment is raised, a certain amount of service in making examinations and copies, could also be allowed on each share, which computed at bare cost of such service, should not exceed a small per cent. dividend, say one or more per cent.<sup>6</sup> The best manner of making this appeal is a matter for careful deliberation; it is suggested that it be left to the personal efforts of committees of three or more members of the Society, in each city and large town of the country, whose influence and position will command an appreciative consideration of what they may present in the way of professional advancement, and the dissemination of practical knowledge.<sup>5</sup>

How great are the material interests of this country which may be benefited by the undertaking in view, appears from an examination

<sup>4</sup> See views of Mr. Charles Paine, page 229.

<sup>5</sup> See views of Mr. Charles Hermany, page 228.

<sup>6</sup> Mr. Hermany would strike this clause out.



of but this important one: in 1880 the first 23 miles of railway were built; on January 1st, 1874, in round numbers, were operated 70 600 miles, which cost \$3 784 000 000, or over \$50 000 per mile. The average net earnings were 35 per cent. of the gross, and but 3½ per cent. on the total cost—ranging by the average of States, from 7½ per cent. to less than nothing.

In reference to the foregoing, members of the committee expressed views as follows:

MR. ALFRED P. BOLLER.—There is no question about the importance of such a library scheme as outlined. The main point is to present it to the parties to whom we must look for material aid, so as to inspire confidence in the plan, to impress them with the importance we feel it possesses, and that this Society is the proper custodian for the trust.

This can only be accomplished by personal effort; to aid in the matter a pamphlet should be prepared, setting forth briefly the history, objects, aims and successes of the Society, and the character of its membership, the close relation between the advancement of engineering and our national prosperity, and the great value of a complete collection of professional literature, reports, models and the like to capitalists and others interested in public improvements, mines, manufactures, and industrial operations. In the pamphlet suggested, the commercial advantage should be forcibly shown; in other words, a strong appeal should be made to the interests of the investor in all enterprises which are contingent upon the success of engineering. A blank pledge should accompany each pamphlet, and the distribution be subject to the discretion of selected committees.

The library should be operated for the public good, under such restrictions as the protection of the Society and its interest demands; but the policy adopted should be broad enough to render the benefits readily accessible to searchers after technical or commercial information.

MR. THOMAS C. CLARKE.—“The plan” outlined on page 226 should involve “the preparation of concise abstracts of new works, reports, scientific and technical journals, proceedings of societies and other publications as received,”—also of works on engineering subjects in other libraries—as of the University of Pennsylvania, Boston Public Library and Cornell University, and those owned by members not in the library proposed.

Instead of \$25 000 “required for immediate outlay” (see page 227), in my opinion—based on what has been done at the Univer-

sity of Pennsylvania—for a nucleus \$10 000 would be large enough, “and an annual expenditure for,”

“New Books”.....	\$2 000
Rent of upper rooms in fire-proof building with elevator	1 000
“Clerical assistance, shelving, binding, &c.”.....	2 000
“Amounting to”.....	\$5 000
From this deduct, as properly chargeable to general revenue of Society.....	1 500

There remains..... \$3 500

Which is a seven per cent. income on..... \$50 000

Whence the total cost of endowment

required at present is..... \$60 000  
which will start the library, if \$125 000 cannot be had.

MR. CHARLES HERMANY.—It is stated (page 226) that “in these times of cheap and rapid expressage, duplicate volumes may be loaned to a non-resident member, and at a small risk and cost sent to him, no matter how remote his residence is.” This plan will not do, for the reason that nine out of every ten books sent out, would never find their way back to the library.

For the statement of plan to obtain the requisite funds (page 227), substitute: *Donations* may be solicited in amounts from \$100 to \$1 000, and for each, the donor be allowed to name a person who shall enjoy the privileges of the library, the same as if he were a member of the Society, but not have a voice in its management, as proposed.

It does not seem prudent to offer any inducement to parties making donations, except the use of the library and such recognition of the donor's liberality and public spirit, as will tend to make it perpetually an honor to his munificence—hence the clause referring to service in making examinations and copies (page 227) should be stricken out.

If \* \* \* it is decided to recommend immediate action upon this subject by the Society, it is suggested that at the Annual Meeting a resolution be adopted, concisely setting forth, the intention of establishing an Engineer's library under the management of the American Society of Civil Engineers, its plan, scope and national utility, and making a strong appeal to capitalists, manufacturers and corporations, for donations sufficient for a permanent endowment. Also that the Society appoint a committee of three members in each city, whose duty it shall be to make effective the Society's appeal.

Mr. CHARLES PAINE.—It appears to me that appeals should be left to religious and charitable societies, which have hard work enough now to get money with which to carry on their enterprises.

Civil Engineers want this library for *their own benefit*, and only remotely for the benefit of others. They should increase their dues or the number of members, sufficiently to provide a permanent fund for the increase and proper care of the library. The collections already made are not useful, because there is no room in which to display them, nor money to bind the volumes. We should, without any endowment fund, have a natural increase, by contributions, far in excess of

\* Referring to page 227.

anything yet seen, if provision were made to make the collections useful. I believe, if we had convenient rooms, the library serviceable and well catalogued, with information supplied by librarian, as happily suggested, and \$1 000 (or more) per annum, devoted to purchase of the *best new books*, we would soon be beyond the necessity of appeal for help. We can do these things, and grow in a natural and healthy way. I do not believe in the other way, for a man or for a society.

Respectfully submitted for the consideration of the Society, and such action thereon as may seem at this time fit and proper.

G. LEVERICH,

Secretary of the Committee.

## TREASURER'S STATEMENT

OF CURRENT RECEIPTS AND EXPENDITURES; QUARTER ENDING MAY 1ST, 1875.

	RECEIVED.	EXPENDED.	
In February .....	\$993.00	\$821.70	
" March.....	755.25	701.75	
" April.....	597.39	2 132.01	
Amounts.....	\$2 345.64	\$3 655.46	
" Quarter ending February 1st (page 197).....	3 629.12	1 222.97	
Totals.....	\$5 974.76	\$4 878.43	
Balance .....			\$1 096.33
" November 1st, 1874.....			785.38
" on hand .....			\$1 881.71

## NEW BOOKS ON

## ENGINEERING AND TECHNOLOGY.

Air in Mines; Friction of.—J. J. Atkinson. New York. 18vo. *D. Van Nostrand*. \$0.50.  
Ancient Scotland, the Hill Forts, Stone Circles, and other structural Remains of — Christian MacLagan. Edinburgh. Folio. *Edmonston*. 31s. 6d.

Aquarium, the Book of.—Shirley Hibberd. New ed., rev. and enl. London. 12mo. *Groombridge*. 3s. 6d.

— the Book of the fresh Water—Shirley Hibberd. New ed., rev. and enl. London. 12mo. *Groombridge*. 2s.

Army, British—in 1875. J. Holmes. London. 12mo. (*D. Van Nostrand*, N. Y.) \$1.25.

Balance Spring, Prize Essay on — and its isochronal Adjustments. Moritz Immisch. London. 12mo, illus. (*D. Van Nostrand*, N. Y.) \$1.00.

Barometric Hypsometry, Contributions to — with Tables for Use in California. Prof. J. D. Whitney. Boston. Roy. 8vo. *Little, Brown & Co.* \$1.00.

Blowpipe, practical Guide to the Determination of Minerals by the — C. W. C. Fuchs. Trans. and ed. by T. W. Danby. London. 8vo. *Field & Tuer*. 5s.

Calculus, Elements of the differential and integral—by a new Method, founded on the true System of Sir Isaac Newton, without the Use of Infinitesimals or Limits. C. P. Buckingham. Philadelphia. 12mo. *Griggs*. \$2.00.

—Elementary Treatise on integral—Benjamin Williamson. London. 8vo. *Longmans*. 10s. 6d.

Carpentry and Joinery; or, a useful Manual for the Many. S. T. Aveling. New ed. London. 16mo. *Warne*. 2s.

Catalogue (the English) of Books, for 1874, containing a complete List of all the Books published in Great Britain and Ireland in 1874, with their Sizes, Prices, and Publishers' Names; an Index of Subjects, &c. London. Roy. 8vo. *Low*. 6s.

Chemistry of Light and Photography. Prof. Vogel. New York. 12mo. *Appleton*. \$1.75.

Coloring, Grammar of—applied to decorative Painting and the Arts. Geo. Field. New ed., rev., enl. and adapted to the Use of the ornamental Painter and Designer. Ellis A. Davidson. London. 12mo, illus. (*D. Van Nostrand*, N. Y.) \$1.50

- Commercial Hand-Book of chemical Analysis. A. Nomandy. New ed., enlarged and rewritten, by Henry M. Noad. London. 8vo. Lockwood. 2s. 6d.
- China Collector's Pocket Companion. Bury Palliser. Enl. and rev. ed., with many Monograms. London. 12mo. Low. 5s.
- Construction, Elements of practical—for the use of Students in Engineering and Architecture. Part I, Structures in direct Tension and Compression. Samuel Downing. London. 8vo, with folio Atlas. (D. Van Nostrand, N. Y.) \$7.00.
- Decoration, Examples of mediæval Foliage and colored Decoration—taken from Buildings of the Twelfth to the Fifteenth Century. James Kellaway Collins. Boston. 4to, illus. Osgood. \$15.00.
- Drainage, rudimentary Treatise on—of Towns and Buildings. G. Drysdale Dempsey. 5th ed. (Weale's Series.) London. 12mo. Lockwood. 2s. 6d.
- Drawing, National Drawing Books. Designed by D. Mackinlay. Nos. 25 and 26: Mechanical. London. Oblong 4to. Collins. Each 2d.
- Dynamics, Lessons on rigid—G. Pirie. London. 12mo. Macmillan. (New York.) \$2.25.
- Electricity: its Theory, Sources, and Applications. John T. Sprague. London. Post 8vo. Spens. (New York.) 8s.
- Engineering Papers. Mortar: a Paper read at a supplemental Meeting of the Institution of Civil Engineers, May 23d, 1873. Practical Iron-work: a Paper read at a supplemental Meeting of the Institution of Civil Engineers, April 24th, 1874. Retaining Walls: a Paper read at Meeting of the Edinburgh and Leith Engineers' Society, May 6th, 1874. With Addenda. C. Graham Smith. London. 8vo. Spens. (New York.) \$2.00.
- Fungi: their Nature and Uses. M. C. Cooke, Ed. by M. J. Berkeley. New York. 12mo. illus. Appleton. \$1.50.
- Gas: the quantitative Estimation of Ammonia and Sulphur in Coal Gas. F. W. Hartley. London. 12mo. (D. Van Nostrand, N. Y.) \$1.00.
- Works: Treatise on — Samuel Hughes. 5th ed. Rev. by W. Richards. (Weale's Series) London. 12mo. illus. Lockwood. 3s. 6d.
- Gems: the Science of —, Jewels, Coins and Medals, ancient and modern. New ed. rev. and cor. Archibald Billings. London. Roy. 8vo. illus. (D. Van Nostrand, N. Y.) \$10.50.
- Houses: Village and Country: or, cheap Homes for all Classes. Comprising 84 pages of Designs. New York. 4to. illus. Judd. \$6.00.
- Hydraulic Tables: Coefficients and Formule for Finding the Discharge of Water from Orifices, Notches, Weirs, Pipes and Rivers. 3d ed. with Additions consisting of new Formule for the Discharge from tidal and flood Sluices and Syphons, general Information on Rainfall, &c. John Neville. London. 8vo. Lockwood. 14s.
- Mechanical Text Book. W. J. M. Rankine. 2d ed. London. Post. 8vo. Griffin. 9s.
- Mechanics: Lessons on Elementary Mechanics; introductory to the Study of physical Science. London. 12mo. (D. Van Nostrand, N. Y.) \$1.75.
- Millwright and Engineer's Pocket Companion. 17th ed. rev., to which is added a new Table of fractional Numbers. William Templeton. London. 12mo. Simpkin. 5s.
- Nature and Life. Facts and Doctrines relating to the Constitution of Matter, the new Dynamics, and the Philosophy of Nature. Ferdinand Papillon. Transl. from the 2d French ed., by A. R. Macdonough. New York. 12mo. Appleton. \$1.50.
- Navigation, in Theory and Practice. Henry Evers. New York. 12mo. Putnam. \$1.50.
- Ornithology: a History of North American Birds. Spencer F. Baird, Thomas M. Brewer and Robert Ridgway. The Land Birds. Illustr. by Cuts and Plates of full Life-size illustr. of the Head of each Species. (In 3 vols.) Vol. 3. Boston. Sm. 4to. Little, Brown & Co. \$10; colored by hand, \$20.
- Patents: Report of the International Patent Progress in Vienna, 1873. Hermann Grothe. Trans. by A. Hildebrandt. Manchester. 8vo. Heywood. 1s.
- Piers: Iron Cylinder Bridge Piers. Calculations and Investigations necessary in designing Them, with Tables for Facilitating the Calculations; Formule; Remarks on Foundations and the Materials employed. John Newman. London. 8vo. Spens. (New York.) \$0.06.
- Pottery and Porcelain, English; being a concise Account of the Development of the Potter's Art in England. London. 8vo, illus. Bazaar Office. 5s.
- Prices.—Skyring's Builders' Prices, 1875. 65th ed. London. 8vo. Simpkin. 4s.
- Projectiles and rifled Cannon. Systems of Projectiles and Rifling, with practical Suggestions for their Improvement, as embraced in a Report to the Chief of Ordnance, U. S. A. John G. Butler, Ordnance Corps, U. S. A. With Appendix containing the Report of the Board on experimental rifled Guns on the Proof of an eight-inch converted Rifle. New York. 4to, illus. D. Van Nostrand. \$7.50.
- Punctuation simplified. A simple Mode of Learning the proper Use of the Comma, Colon, &c., for the Guidance of Printers, Fainters, and Newspaper Correspondents, and also for the use of Schools. William Finch Crisp. Great Yarmouth. 32mo. 6d.
- Pyramid. Philitis; or Solution of the Mystery which for Four Thousand Years has shrouded the great Pyramid in Egypt. New and en. ed. Charles Casey, Dublin. 8vo. Carson. 2s.
- Railway Accidents prevented by perfect Safety Railway Carriages: a Letter to the Right Hon. Benjamin Disraeli. By F. S. T. London. 8vo. E. Wilson. 1s.
- Report on the Accident which occurred at Thorpe, near Norwich, on 10th September, 1874. With Plan. (Parliamentary Report.) London. 1s. 3d.
- Reports of Inspectors on Railway Accidents. 1874. Part V. May to August. 3s. Part VI. September to October. 2s. Part VII. November. 2s. (Parliamentary Reports.) London.
- Digest of Railway Decisions; comprising all reported American Cases in which a Railway Company is a Party, and all other Cases in which Railway Law is determined. John F. Lacey. Cincinnati. 8vo. Callaghan. \$10.00.
- Manual Shareholder's Guide, 1875. London. 8vo. W. F. Adams. 12s.
- Hand-book and Appendix of all the Stations, Junctions, Sidings, Collieries, &c., on the Railways in the United Kingdom. New ed., rev. and en. London. 8vo. Oliver & Airey. 3s.
- Remains of Lost Empires; Sketches of the

- Buins of Palmyra, Nineveh, Babylon and Persepolis. With Notes on India and the Cashmerian Himalayas. P. V. N. Myers. London. 8vo, illus. *Low*. 16s.
- Scientific, political, and speculative Essays. Herbert Spencer. Vol. 3. New ed., containing an Appendix. London. Post 8vo. *Williams & Norgate*. 7s. 6d.
- Statistics of the World. Cont. I.—Area, Form of Government, Heads of Government, Population, Expenses, Debt, Paper Money, Standing Army, Navy, Merchant Vessels, Imports, Exports, Chief Produce, Coins and their Value at the U. S. Mint, Liquid and Grain Measures, Weights and Linear Measures, Capitals and principal Cities, Population of Cities, of all Countries, and Tables showing the principal Creeds of the World, Statistics of Christianity, religious Statistics of Europe, religious Statistics of the U. S., the Railroads of the World, the Railroads of the U. S., postal Statistics of the World, the Telegraphs of the World, the Presidents of the U. S., Presidential Elections from 1788 to 1872, general School Statistics of the U. S., school Statistics of 50 Cities. Ed. by Prof. Alexander J. Schem. 3d rev. ed. New York. Obl. folio. *Lee & Shepard*. \$0.50.
- Military Surveying and Reconnaissance, Notes on — 3d ed. London. 8vo. (*D. Van Nostrand, N. Y.*) \$3.75.
- Tables. Logarithmic and trigonometrical—for approximate Calculation. J. T. Bollowley. London. 8vo. *Collins*. 6d.
- United States textile Manufacturers' Directory: comprising Woolen, Cotton, Silk, Jute, Flax, Linen and Paper Establishments, and a List of Iron and Steel Manufacturers. 1871. Nat. Assoc. of Wool Manufacturers, Boston, Mass.; N. E. Cotton Manufacturers' Assoc., Boston, Mass.; Silk Assoc. of America, N. Y. City; Am. Iron and Steel Assoc. Philadelphia. 8vo. *Nat. Assoc. of Wool Manufrs.* \$5.
- Timber. Reports respecting the Production and Consumption of Timber in Foreign Countries. (Parliamentary Report.) London. 8vo. 11d.
- Trade. Accounts of the Trade and Navigation of the United Kingdom for January and February, 1875. (Parliamentary Report.) London. 8d.
- Piece Goods, Yarn and Woolen Tables: showing the Net Returns in Sterling for Shipments via the Suez Canal, to China. Calculated with various Rates of Charges. Freight, &c., and at different Rates of Exchange per Dollar and per Tael. W. Kerfoot Hughes. London. Roy. 8vo. *Stimpkin*. 42s.
- Zoology. Outlines of — and comparative Anatomy. Montgomery W. Ward. Dublin. 12mo. *Fannin*. 3s. 6d.

## ANNOUNCEMENTS.

**MEETINGS.**—The next *stated* meeting of the Society will be held Wednesday, May 19th, at 8 o'clock P. M., for social intercourse and professional improvement.

The next *stated* meeting of the Board of Direction will be held Wednesday, June 2d, at 4 o'clock P. M., for the transaction of regular business.

The next *regular* meeting of the Society will be held Wednesday, June 2d, at 8 o'clock P. M., when plans for the Seventh Annual Convention will be completed, and other business taken up.

Attention is called to the change of time of regular meetings of the Society from 1 to 8 o'clock P. M., and of *stated* meetings of the Board of Direction from Monday preceding the first Wednesday in the month at 2 o'clock P. M., to the first Wednesday (the same as that of regular meetings of the Society) at 4 o'clock P. M.

**THE SEVENTH ANNUAL CONVENTION** of the Society will be held at Pittsburgh, Pa., on Tuesday, Wednesday and Thursday, June 8th, 9th, and 10th next.

Sessions for the consideration of professional subjects are set down for each day from 9½ o'clock A. M. to 1½ o'clock P. M., and one for the transaction of such regular business as may be brought up—at 7½ o'clock P. M. on

Tuesday. These meetings will be held in the Select Council Chamber, Municipal Hall; and at the first session it may be determined to devote more time than here named, to the meetings on Tuesday and Thursday—that on Wednesday the whole day may be spent in an excursion to the water works, the steel and iron works, and other manufacturing establishments in and about Pittsburgh, including the Blair Iron Sponge Furnace, the Lucy Furnace, Dank's Rotary Puddling Furnace, Edgar Thomson Steel Works, Millar Barr & Parkin's Steel Works, Union Iron Works Beam Mill, Keystone Bridge Works, McKeesport Tube Works, New City Water Works, &c., for visiting which, special trains on the various railways have been placed at the disposal of the local committee.

The Convention Dinner will be had on Wednesday, at 7½ o'clock P. M., at the Monongahela House, which will be headquarters for members attending the Convention.

The remaining available time will be devoted to other semi-professional excursions and to meetings for social intercourse, to be duly announced, at the first session of the Convention.

On Friday, June 11th, there will be an excursion, by invitation of the Alleghany Valley R. R. and the "Associated Pipe Lines"—to the oil regions of Butler Co., Pa.; returning to Pittsburgh late that evening.

In accordance with the rules governing Conventions, adopted by the Society, December 2d last,\* a list of topics to be considered at the regular sessions is here submitted with reference to the Papers treating these subjects, published in Transactions since April, 1874.

# 1. BRIDGES.

## A. ARCHED BRIDGES.

XCVIII. Upright Arched Bridges. J. B. EADS. *October and following.*

## B. DRAW BRIDGES.

XCII. Draw Spans and their Turn Tables. C. S. SMITH. *August.*

CV. Principles of Construction of, and Calculations of Strains in revolving Draw Bridges. C. HERSCHEL. *March.*

XCVII. Utica Lift Draw Bridge. S. WHIPPLE. *September.*

## C. FOUNDATIONS.

LXXXIV. Replacing a Stone Pier on a Pile Foundation. J. A. MONROE. *June.*

XCIII. Foundations for Brooklyn Anchorage, East River Bridge. F. COLLINGWOOD. *August.*

## D. ERECTION OF STRUCTURES.

XCIX. Notes on the Erection of Illinois & St. Louis Bridge. T. COOPER. *November.*

## E. BRIDGE ACCIDENTS.

Reports on the Means of averting Bridge Accidents, submitted March 3d, 1875. J. B. EADS, Chairman of Committee. *This number.*

# 2. STEAM ENGINES AND FURNACES.

## A. PUMPING ENGINES.

Report on comparative Examination of the principal Pumping Engines in Use. G. P. LOW, Jr., Chairman of Committee. *This number.*

## B. COMPOUND ENGINES.

CIV. Compound and Non-Compound Engines, Steam Jackets, &c. C. E. EMEY. *February.*

## C. FURNACES.

CII. Efficiency of Furnaces burning Wet Fuel. R. H. THURSTON. *December, January.*

# 3. RAILROADS.

## A. RAILS.

LXXXVIII. Report on the Form, Weight Manufacture and Life of Rails. A. WELCH, Chairman of Committee. *July, and this number.*

..... Memoir on Rails. A. WELCH. *July.*

LXXXIX. Weight of Rails and breaking of Iron Rails. O. CHANUTE. *August.*

## B. RAILWAY SIGNALS.

Report on Railway Signals. J. D. STEELE, Chairman of Committee. *This number.*

## C. RAPID TRANSIT IN LARGE CITIES.

CVI. Rapid Transit and Terminal Freight Facilities. O. CHANUTE, M. N. FORNEY, A. WELCH, C. K. GRAHAM, F. COLLINGWOOD. *Part I. March.*

## D. CHEAP FREIGHT TRANSPORTATION.

CVI. Rapid Transit and Terminal Freight Facilities. (The same.) *Part II. March.*

## E. RAILWAY SYSTEMS CONTRASTED.

LXXXV. European Railways, as They appear to an American Engineer. W. H. WHITE. *June.*

# 4. STRENGTH OF MATERIALS.

## A. TESTS AND TESTING MACHINES.

Report on Tests of American Iron and Steel. W. S. SMITH, Chairman of Committee. *This number.*

Report on a Testing Laboratory. O. CHANUTE, Chairman of Committee. *To be called for.*

LXXXII. Mechanical Properties of Materials of Construction. R. H. THURSTON. *May.*

## B. THEORY OF FLEXURE.

LXXXIII. Experiments showing the Character and Position of Neutral Axes as seen by polarized Light. L. NICKERSON. *June.*

XCI. Resistance of Beams to Flexure. J. G. BARNARD. *August.*

# 5. RIVERS AND RESERVOIRS.

## A. LEVEES.

CI. Levees of the Mississippi River. C. G. FORSHEY. *December.*

## B. RIVER MOUTH.

CVIII. Delta of the Mississippi, considered in Relation to an open River Mouth. J. G. BARNARD. *This number.*

## C. RAINFALL AND THE RESULTING WATER SUPPLY.

LXXXVII. Notes on the Flow of the West Branch of the Croton River. J. J. R. CROES. *July.*

## D. GAUGING OF STREAMS.

Resolution offered April 7th, by J. J. R. CROES. *April. (Proceedings, page 210.)*

# 6. MASONRY.

## A. RETAINING WALLS AND DAMS.

LXXXVI. Retaining Walls—an Attempt to reconcile Theory with Practice. C. CONSTABLE. *July.*

XC. Failure of the Dam on Mill River. J. B. FRANCIS, T. G. ELLIS, W. E. WERTHEN. *August.*

CII. Memoir of the Construction of a Masonry Dam. J. J. R. CROES. *February.*

\* Report "On Annual Conventions," page 172.

# B. CEMENT AND CONCRETE.

CIX. Fabrication of Beton Blocks by manual Labor. S. HAMILTON. *This number.*

# C. DOCKS AND WHARVES.

XCVI. Improvement of the Water Front City of New York. J. D. VAN BUREN, Jr. *September.*

# D. NOMENCLATURE AND CLASSIFICATION.

Resolution offered April 7th, by J. J. R. CROES. *April. (Proceedings, page 210.)*

# 7. MISCELLANEOUS.

## A. FIRES IN COAL MINES.

XCIV. Conflagration in the Coal at Kidder Slope. M. C. RYELL. *September.*

## B. PRESERVATION OF TIMBER.

XC. The Toredon Navalis, or Ship Worm. G. W. R. BAYLEY. *September.*

## C. TECHNICAL EDUCATION.

C. The Education of Civil Engineers. T. C. CLARKE. *November, December.*

# FOR THE BUSINESS SESSION:

## I. POLICY OF THE SOCIETY. CONSTITUTIONAL CHANGES.

## II. INCREASE OF ASSOCIATE AND FELLOW MEMBERSHIP, AND OF THE SOCIETY'S FUNDS.

## III. ESTABLISHMENT OF AN ENGINEERING LIBRARY.

Informal Report. G. LEVERICH, Secretary of Committee. *This number.*

## IV. NATIONAL RECOGNITION OF THE SOCIETY.

Report to be submitted. J. W. ADAMS, Chairman of Committee.

## V. PLAN FOR THE BENEFIT OF FAMILIES OF DECEASED MEMBERS.

Resolution offered April 7th, by W. E. WORTHEN. *April. (Proceedings, page 210.)*

These topics will be called for discussion in regular order, and members are invited to take part in person or by sending what they would say, to the Secretary. It is hoped that those who have memoranda of experience or data relating to any of the subjects named, will take care to present it.

Papers for the Convention may be announced by title, but none requiring more than ten minutes' time are to be read.

Members have been requested by circular to state whether they will attend the Convention, join the excursion to the oil regions, be present at the Convention dinner, &c.

The usual arrangements have been made in regard to transportation. Members from the West should apply at once to William P. Shinn (Chairman), Alleghany Valley R. R.,

Pittsburgh, Pa., and those from the East, to the Secretary.

Further information may be had from the Committee on Seventh Annual Convention—Messrs. Julius W. Adams, G. Leverich, John Bogart and Charles Macdonald, of New York; and William P. Shinn, Otho E. Michaelis and William Metcalf, of Pittsburgh.

THE NEW ROOMS OF THE SOCIETY are on the southeast corner of Broadway and Twenty-third street, nearly opposite Fifth Avenue Hotel, and overlooking Madison square; entrance 4 East Twenty-third street.

Until further notice they will be open from 9 o'clock A.M. to 9 o'clock P.M. on Mondays, Wednesdays and Fridays, and to 6 o'clock P.M. other days, except Saturdays, when they will be closed at 3 o'clock P.M. All the meetings of the Society are henceforth to be held at 8 o'clock P.M.; and the rooms will be open every evening in the week, if the attendance of members on the evenings named above, shows that such is desirable.

For the present, the elevator will run to 10 o'clock on Wednesday evenings.

Members—particularly those from out of town—are invited to make these rooms their headquarters. Appointments with other parties may be kept here, and for such and similar personal matters, a private room can now be had.

THE NUMBER OF PAGES IN TRANSACTIONS (as before announced) varies in the several issues on account of the difference in length of the papers contained; in this instance the usual number is exceeded to include the several papers and reports set down for consideration at the Seventh Annual Convention. Of the 600 pages—which, under the present rule, are to be published yearly—500 are now in print; whence, unless this rule is changed, but 100 pages remain to be included in the issues for the five months of the year still to come, or 20 pages for each number.

A LIST OF MEMBERS of the Society, with their addresses, was issued on March 30th. The types will be kept standing; members are requested to inform the Secretary of errors noted, that corrections may be made as on next page, and in subsequent editions of the list.

ADDRESSES ARE WANTED by the Secretary, as follows:

Blackwell, Edward R., late of Norristown, Pa.

Stahlberg, Albert J., late of Los Angeles, Cal.



## LIST OF MEMBERS.

## ADDITIONS.

BLAND, GEORGE P. [J.]	Ass't Engineer, Pennsylvania R. R., Philadelphia, Pa.	April 23, 1875.
BOUSCAREN, G. L. F.	Ass't Engineer, Cincinnati Southern R. R., Cincinnati, O.	" 19, "
HOWELL, CHARLES W.	Captain of Engineers, U. S. A., New Orleans, La.	" 30, "
MERRIMAN, MANSFIELD [J.]	New Haven, Conn.	May 18, "
PIERSON, STEPHEN C. [J.]	Meriden, Conn.	" 5, "
RICE, EDWARD C.	2394 Pine St., St. Louis, Mo.	" 15, "
TASKER, CHARLES A. [J.]	Res. Engineer, Cincinnati Southern R. R., Pleasant Hill, Ky.	April 23, "

## CHANGES AND CORRECTIONS.

BENDER, CHARLES.....	71 Broadway, New York.
BISSELL, H.....	(Care American Society Civil Engineers), New York.
COGSWELL, WILLIAM B....	Mine La Motte, Mo.
EMERSON, GEORGE D.....	Rollo, Mo.
FINK, RUDOLPH.....	Manager New Albany Rail Mill Co., New Albany, Ind.
GOTTLEIB, ABRAHAM.....	Engineer Keystone Bridge Co., Metropolitan Block, Chicago, Ill.
GRAHAM, CHARLES K.....	Eng. in Chief, Dept. Docks, 117 Duane St., New York.
GREENE, GEORGE S., Jr....	Cor. Third Av. and 138th St., New York.
HALL, G. THOMAS.....	Ass't Engineer, N. Y. State Canals, Whitehall, N. Y.
HAMILTON, SCHUYLER.....	(Care R. Ray Hamilton,) 229 Broadway, New York.
KATTE, WALTER.....	Engineer Keystone Bridge Co., 211 Washington Av., St. Louis, Mo.
KENNEDY, WILLIAM H.....	Sec. and Treas. French Bar Mining Co., Helena, M. T.
MACDONALD, CHARLES.....	(Director) 52 Wall Street, New York.
MACLAY, WILLIAM W.....	Ass't Eng. Dept. of Docks, 117 Duane St., New York.
PONIER, P. PORTER [J.]...	Stevens Institute of Technology, Hoboken, N. J.
SEARLES, WILLIAM H.....	80 Broadway, New York.
SMITH, T. GUILFORD.....	Secretary, Union Iron Co., Buffalo, N. Y.
SOULERIN, LEON.....	Milwaukee, Wis.
STALEY, CADY.....	Prof. Engineering, Union College, Schenectady, N. Y.
ST. JOHN, I. M.....	(Gen'l Superintendent New River Car Works) White Sulphur Springs, W. Va.
THURSTON, ROBERT H....	Prof. Mechanical Engineering, Stevens Institute of Technology, Hoboken, N. J.
WILSON, WILLIAM W.....	Chief Engineer Water Works, Yonkers, N. Y.
WOOD, DE VOLSON.....	Prof. Civil Engineering, Stevens Institute of Tech- nology, Hoboken, N. J.

# AMERICAN SOCIETY OF CIVIL ENGINEERS.

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## PROCEEDINGS.

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### MINUTES OF MEETINGS.

(Abstract of such as may be of general interest to members.)

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#### OF THE SOCIETY.

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MAY 19TH, 1875.—The new rooms of the Society not being ready for evening use, this stated meeting was not held.

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JUNE 2D, 1875.—A regular meeting was held at 8 o'clock P.M.

Report was made of arrangements for the Seventh Annual Convention, and the resolution submitted April 7th, referring to the organization within the Society, of a Mutual Benefit Association for the relief of families of deceased members, was considered.

It was announced that Messrs. Theodore G. Ellis and James P. Kirkwood had been appointed a committee to present a memorial of Mr. James Laurie, and Messrs. Charles B. Brush and Charles L. McAlpine—of Mr. Isaac D. Colman, deceased members of the Society.

An informal discussion of professional topics followed.

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JUNE 8TH—12TH, 1875.—THE SEVENTH ANNUAL CONVENTION of the Society was held at Pittsburgh, Pa., June 8th, 9th and 10th, followed by an excursion to the oil regions of Butler County, Pa., June 11th, and to Chautauqua Lake, June 12th.

These members were in attendance :—Messrs. Marshall Morris of Jefferson Mines, Ala. ; Theodore G. Ellis of Hartford and Stephen C. Pierson of Meriden, Conn. ; A. G. Menocal of Washington, D. C. ; Abraham Gottlieb, Edward Hemberle and Max Hjortsberg of Chicago,

ills.; Robert L. Read of Indianapolis and Rudolph Fink of New Albany, Ind.; Morris S. Belknap, William R. Belknap and Frederick de Funiak of Louisville, Ky.; Russell H. Curtis, Joseph P. Davis, Clemens Herschel and Henry F. Walling of Boston, William Rotch of Fall River, Oliver E. Cushing of Lowell, Emory C. Davis of Northampton and A. D. Briggs of Springfield, Mass.; William D. Pickett and C. Shaler Smith of St. Louis, Mo.; Robert Fletcher of Hanover, N. H.; Charles B. Brush, P. Porter Poinier and Arthur Spielmann of Hoboken, Levi W. Post of Jersey City, William H. Burr of Milburn, William E. Kelly of New Brunswick, Theodore Cooper of Phillipsburgh and Clark Fisher of Trenton, N. J.; Charles H. Fisher and David M. Greene of Albany, Alexander L. Holley of Brooklyn, Louis H. Knapp and Oscar T. Whitford of Buffalo, Leonard F. Beckwith, Alfred P. Boller, Francis Collingwood, Robert L. Cooke, Charles W. Copeland, J. James R. Croes, Charles E. Emery, George E. Harding, G. Leverich, Charles Macdonald, W. Milnor Roberts, Richard P. Rothwell, William H. Searles, Henry W. Stuckle and William H. Wiley of New York, H. Wadsworth Clarke of Syracuse, Frederick B. Howard of Waverly and G. Thomas Hall of Whitehall, N. Y.; Edward N. Beebont of Ashtabula, Louis G. F. Bouscaren, Thomas D. Lovett and Frederick C. Weir of Cincinnati, M. J. Becker of Columbus and John W. Hill of Dayton, Ohio; Charles Davis of Alleghany City, C. S. Maurice of Athens, Calvin E. Brodhead of Bethlehem, J. Foster Flagg of Meadville, Thomas C. Clarke, Franklin C. Prindle, Joseph S. Smith and William W. Wright of Philadelphia, Amory Coffin of Phoenixville, Phinehas Barnes, B. F. Jones, Andrew Kloman, William M. Lyon, William Metcalf, Otho E. Michaelis, William P. Shinn, Felician Slataper and David A. Stewart of Pittsburgh, J. Dutton Steele of Pottstown and James Archbald of Scranton, Pa., and Samuel M. Gray, J. Albert Monroe and J. Herbert Shedd of Providence, R. I.

The several sessions of the Convention were held for the consideration of professional subjects and the transaction of regular business, at Municipal Hall, June 8th and 10th; the Convention dinner was had at the Monongahela House, June 11th.

THE FIRST AND MORNING SESSION was called to order, Tuesday, June 8th, at 10 o'clock, by Vice-President Roberts.

He spoke as follows:—The President of the Society has been unavoidably prevented from attending this Convention; peculiar duties devolving upon him in his official connection with the city of Brooklyn imperatively demand his attention at this time. In his absence it becomes my duty, as one of the Vice-Presidents, to open the Convention.

As there was not sufficient time or opportunity to arrange a regular paper or annual resume of the yearly proceedings of the

Society, I thought it would be an easier task to offer a few appropriate remarks touching this place of annual meeting, the city of Pittsburgh. I trust that the members present will make due allowance for any lack of order or want of perspicuity that may appear, and turn their attention more critically to the things referred to, than to the style in which such are introduced.

It so happens that this city has been, for years at a time, at several periods of my pro-

professional life, my home; I know its people and its institutions well enough to give, in advance, full assurance of a friendly welcome on the part of the citizens, and to guarantee an appreciative reception, and an abundance of objects well calculated to interest the engineering mind as well as to command the respect and admiration of our members as men.

In recalling to recollection various events and scenes which have tended to endear the old smoky city to me personally, it occurs that a glance at some of them, since they relate, as it were, to stepping stones in its progress, may not be wholly out of place or uninteresting—especially to those who now visit Pittsburgh for the first time. I need not go back, in the last century, to old Fort Duquesne, or repeat the story of Braddock's defeat, which unfortunate event occurred about 10 miles up the Monongahela river; and I will but glance at the part which the young engineer, George Washington, bore in that memorable battle. More than a hundred years ago, the Virginia surveyor pointed to the forks of the Alleghany and the Monongahela as the site for a future city, at the head of the noble Ohio, the point of nearest approach between the waters of the Mississippi and the Atlantic ocean, and he referred to a future water communication. If railroads had been invented at that date, he would undoubtedly have had something to say about a railroad.

Hydraulic engineers—canal engineers—in this country are, as a rule, older, professionally, than railroad engineers, owing to the circumstance that canals were constructed, and many hydraulic contrivances were introduced into the old world, ages before railroads were invented. The early internal improvements here were naturally patterned after such as had preceded them in the eastern hemisphere and under the older civilization. One of the first professional civil engineers in the United States was Mr. Weston, who came over from England, I think, about 1790, to plan and construct the old Union canal of Pennsylvania, between the Schuylkill and the Susquehanna rivers, extending about 80 miles, from Reading to Middletown. He began the work, and erected some brick bridges, &c.; but it was afterward suspended for many years. About 1823, Loammi Baldwin, a distinguished New England canal engineer, resumed the work, but in 1824 he gave place to Canvass White, an eminent New York engineer, who had been for years actively engaged on the great canal between Albany and Buffalo—"Clinton's Ditch," as it was sometimes

called—which was begun in 1817 and opened in 1825.

About that time, civil engineering in the United States began to assume definite shape, but only or chiefly in connection with canals, and analogous works. There were bridge builders before that in the United States. Burr and Wernwag had acquired distinction as the constructors of the wooden bridges over the Delaware at Trenton, the Schuylkill at Philadelphia, and the Susquehanna at Harrisburgh; that over the Delaware, after use for more than sixty years, is now being removed. The Schuylkill "permanent" bridge was destroyed by fire a number of years ago. In 1825, on the Union canal of Pennsylvania, he who now addresses you, first drew chainman and rodman's breath, as a young engineer.

In 1826-7 the first American railroads were laid down, one in Pennsylvania, from Mauch Chunk to the coal mines, 9 miles in length; the other in Massachusetts, at the Quincy granite quarries, about 4 miles long. It is proper, however, to mention here that *mining railroads* existed prior to that date in the immediate vicinity of Pittsburgh, the planning and construction of which appertained to the working mining engineers of those days. You all know how railroads starting in that humble way, not quite fifty years ago, have since grown; how they have stretched, spread and ramified through every state and territory of our expansive and ever expanding Union, until they have come to constitute in the aggregate, the most gigantic machinery, as well as the greatest financial investment on the globe.

In 1824, William Strickland, architect, of Philadelphia, was sent by twenty-four public-spirited citizens of that city to England for the purpose of examining the system then in use—canals—and that proposed—railroads—preliminary to entering upon a grand system of internal improvement in Pennsylvania. He was accompanied by Samuel H. Kneass, then a young architect and engineer, who made the elaborate drawings for the able report which followed, called "Strickland's Report," and which was published in the fall of 1824, and became the text for the important discussions in the Pennsylvania Legislature during its session of 1824-5. Strickland favored the railroad system; but the Legislature, after many deliberations, decided to adopt the canal system; and in 1825, immediately after the adjournment, a number of civil engineers, some having previous canal experience, and others not, were put into the field to survey and locate the main lines of

canal between the Susquehanna river and the Ohio at Pittsburgh.

Messrs. Holgate and Clarke, Pennsylvania surveyors, had, in 1824, devised a scheme for a continuous canal, and suggested a tunnel 4 miles long through the great divide of the Alleghany mountain. James Clarke, who strongly advocated this project, was in consequence thereof ridiculed as a visionary man. Yet therein was nothing visionary; he was merely some years in advance of the times. Meanwhile, during the very same year—1825—the grand Erie canal, between the Hudson and Lake Erie, 360 miles long, was completed and put in operation, confirming the prescience and wisdom of the intelligent few, and astonishing the doubtful many.

Regular railroads were begun in various parts of the country in 1828-9, among them the Baltimore & Ohio, and Albany & Schenectady, the Camden & Amboy, &c. In 1830, dropping for a time my aquatic labors, I surveyed, laid out and constructed, in Schuylkill county, Pennsylvania, my first railroad, and about that time railroad engineers began to be brought forth, obedient to the command—"increase and multiply."

It was not till the close of 1833 that the Pennsylvania mixed system, as it became, was completed between Philadelphia and Pittsburgh, although some of the canal divisions were finished somewhat sooner. The railroad from Philadelphia to Columbia, 80 miles, was opened in 1833. In November, the first train of cars passed over the Alleghany mountains, on the Alleghany & Portage R. R., more than 37 miles long, connecting the Juniata and the Western Division of the state canals. This was at the time a great road, having inclined planes, five on each side of the summit. The steepest and longest had a rise of  $1\frac{1}{4}$  per cent., nearly 6°, and a length of 3 100 feet. The whole rise overcome on the eastern slope of the mountain was over 1 300 feet, and on the western slope over 1 100 feet. The gauge was 4 feet 9 inches. The history of the surveys, location, construction, use and final abandonment of this old railroad would make a very interesting chapter.

The combination of canals and railroads through Pennsylvania, served the public for about twenty years, and until the Pennsylvania R. R. Co. constructed the graded road, without inclined planes, over the mountains, making the present continuous line from Philadelphia to Pittsburgh, 356 miles long.

Pittsburgh had begun a more rapid growth from the opening of the canal and Portage railroad system in 1833-4. Indeed, several

years before, an impetus had been given by the opening of the Western Division of the canal. In February, 1832, about two years after the canal had been finished between Johnstown and Pittsburgh, 104 miles long, a disastrous and memorable flood occurred, which destroyed the canal, locks, &c., in a number of places, and did an immense amount of public and private injury along the Western rivers. I was at that time, senior principal assistant engineer on the Alleghany & Portage R. R., of which Sylvester Welch, the brother of one of our honored members, was the chief. I was detailed to go forthwith over the entire line of the injured works, report upon their condition, and make an estimate of the cost of repairing and rebuilding; rumor having asserted that it would be folly to attempt their resuscitation, owing to the enormous cost. This was the occasion of my first professional visit to this city.

It is only forty-three years ago, yet the Pittsburgh of that time and the Pittsburgh which to-day surrounds us, have but a slight resemblance—only such as there may be between childhood and maturity. Its population was then about 16 000—that of Alleghany borough about 3 000. There were only a little over 20 000 people in Pittsburgh and vicinity, where there are now more than 200 000. Alleghany City alone now has about four times the population that was congregated at the head of the Ohio in 1832; while the two cities and adjacent boroughs contain more than ten times the number, that were here forty-three years ago. Pittsburgh, with about two half paved streets, had then no public lamps, no police, no gas, no city debt, no grand Municipal Hall; now she enjoys all these modern blessings.

Nevertheless, in 1833-4, two locomotives for the Alleghany & Portage R. R., which were in profitable use for many years, were built here. Mr. Totten, a very able Pittsburgh mechanic, then of the firm of Wade & Totten, took the immediate charge of their construction. I aided in obtaining permission from the Chief Engineer to ship from Johnstown to Pittsburgh, a Boston locomotive, which served as the pattern for these. The fact that locomotives were built in Pittsburgh so many years ago is often forgotten, even by Pittsburghers. The reason is, that not another one was built here for nearly thirty years, although various efforts were made to establish a locomotive manufactory. Maj. Wade, who was at the head of extensive foundry and machine shops then, which many years did ordnance work for the United States govern-

ment, was a remarkable man, and a superior mechanical engineer. He was scientific, and he applied his knowledge and great experience, in conjunction with first-class mechanics, in the most practical and successful manner. Not only Pittsburgh, but the entire country, is indebted to him and his able coadjutors for many improvements in the construction of the immense guns manufactured here, as well as for useful and valuable experiments and practical successes in the mixing and manipulation of different classes of metal, required to make perfect work for their heavy castings and machinery of all kinds. The reason that Mr. Totten assigned, for not going on to build more locomotives, was that the work was too trifling, compared with the heavy work they were doing.

It is less than a quarter of a century since the Pennsylvania R. R. was completed; the Pittsburgh, Fort Wayne & Chicago R. R. was started about the same time; and the Alleghany Valley, the Panhandle, the Connelleville and the Wheeling Railroads not long after. Now, Pittsburgh is one of the busiest railroad centres in the country, and the passenger and tonnage business here is enormous. The position of this city, as the centre of a great manufacturing district, is peculiarly advantageous. At the head of the most extensive system of river navigation in the world; surrounded by hills abounding in bituminous coal of the finest quality, the adjacent mountains teeming with iron ore; convenient to the great oil regions, and connected therewith by water as well as by rail; within five hours of the lakes, and twelve hours of the sea-board; in a salubrious climate, and having an abundance of crude essence of kreosote in her atmosphere—it is obviously the "journal" of the universe, whereas Boston only claims to be the "hub."

It would occupy too much time to give a sketch of all the numerous engineering works with which Pittsburgh has been associated, some of which, in the march of improvement, and especially in the advancement of the railroad as the predominating element of general transportation, have entirely disappeared from the scene. Of the once famous *aqueduct* which carried the old State canal across the Alleghany river, between Alleghany City and Pittsburgh, not a vestige remains. Its demolition has been far more complete than that of the ancient *aqueducts* of Rome, which still rear their solid time-covered walls conspicuously above the plain. The old canal tunnel through Grant's Hill has a history. The State canal was

once extended from the Alleghany to the Monongahela river, and one boat passed through. The hill was originally cut down; then an arched canal tunnel was built at the bottom; over this the cut was filled with earth, a street laid out, and houses built. In 1839, the canal, tunnel and locks descending to the Monongahela were repaired at the expense of the State, but the merchants of the city never favored this labor-saving arrangement, and all were allowed to fall into decay. At a later period, only about ten years ago, the Pennsylvania R. R. Co. constructed the present tunnel through the same hill, as its outlet, to the Panhandle R. R., crossing the Monongahela on the handsome iron bridge which now spans the stream, whose name is redolent of a famous liquid which, with the prefix *old*, some love to imbibe.

Iron, among modern engineers, has taken the place of wood, the material with which we had to work in the olden time. There were, it is true, a few iron chain or link bridges fifty years ago, several of which, on the Lehigh river, I saw only a few years later than that date; and I recollect being carried more than sixty years ago, over a wire bridge built by Josiah White, at the falls of the Schuylkill, above Philadelphia. The first modern suspension bridge in this country, was, I believe, built over the Schuylkill, at Callowhill street, Philadelphia, to take the place of the old "permanent" bridge, so called, which was a Wernwag wooden, single span of 340 feet 4 inches. This suspension bridge was designed by the late Charles Ellett, assisted by the late John A. Roebling, who was the engineer in the immediate charge and management of the details. Mr. Roebling afterwards rebuilt the old wooden aqueduct at Pittsburgh, and introduced, in an ingenious manner, wire suspension cables for its support. This structure disappeared with the abolishment of the canal.

At a later day, Mr. Roebling built the elegant bridge at the foot of St. Clair street, which gracefully spans the Alleghany between the two cities. In sight, above, is the fine, substantial iron lattice railroad bridge of the Pittsburgh & Fort Wayne R. R., built by one of our members, Mr. Slataper. At the foot of Smithfield street, over the Monongahela there is another suspension bridge, also the work of Mr. Roebling—the oldest iron bridge in this vicinity, and which has safely passed a vast amount of very heavy tonnage. There is also the Union bridge, recently finished, crossing from the Point to Alleghany, a handsome wooden structure,



well worth seeing. Work has just been commenced on a new suspension bridge from the same point on this side to the south side of the Monongahela, to be elevated 80 feet above the water. Across the Monongahela, are inclined planes, worked by steam, connecting the high plateau with the city, nearly 500 feet below, up and down which, thousands of passengers daily are pleasantly and safely conveyed.

Here bridges, locomotives and cars, steam-boats, engines, machinery, pipes for water and gas, &c., are built, and first class modern furnaces, rolling mills, machine shops, and manufactories of all kinds on the largest scale may be seen.

The iron ores of Pennsylvania, Missouri-Lake Superior, Lake Champlain and Canada, are here brought together in great quantities, scientifically manipulated and transformed into every description of iron and steel, then manufactured into all possible shapes, and finally shipped to every quarter of the Union. The copper ores, from the region around Lake Superior, were at an early day taken in hand by Pittsburgh enterprise, which has in fact, made this city, copper headquarters. It is the same with the petroleum trade of Western Pennsylvania, Ohio and Virginia, which largely centers here. Strangers may well be surprised at its exports.

About 1838, the city of Pittsburgh embarked in the permanent improvement of the navigation of the Monongahela river, by a system of locks and dams, several of which were completed and opened for use, about 1840. This was about the beginning of the coal business, which has since grown to be one of the principal industries of the vicinity. Over 60 000 000 bushels of coal are now annually passed through these locks, and shipped down the Ohio river to the numerous cities and towns along the Ohio and the Mississippi, even as far as New Orleans. The first lock and dam are now within sight, on the Monon-

gahela. For many years, the general government has been engaged in improving the low water navigation of the Ohio by means of wing dams, dredging, &c., but although the permanent improvement of this important stream has been the subject of engineering discussion for nearly or quite forty years, it was only at the last session of Congress that an appropriation was made, to be applied to the construction of the first lock and dam; the dam to be arranged so as to let down, and allow boats, &c. to pass freely during freshets, while the lock may be used during low water, when otherwise boats of any size could not navigate. Should this lock and dam system be successfully introduced on the Ohio river, it will add immensely to the transportation facilities of many states, and save millions of dollars annually to the people of a very large portion of the Union.

In thus merely glancing at the engineering objects of interest which appertain to this locality, the time is consumed, and I must, therefore, refrain from further draughts upon my memory in this connection. Absence for some years, and the rapid growth of Pittsburgh, not only physically, but intellectually, conspire in reminding me that doubtless numerous interesting matters, to which the attention of members will be called, are omitted in this hasty survey. What I have said may, however serve to show you that at no other point in the United States is there to be seen congregated in a space so compact, a greater variety of works especially adapted to gratify intelligent curiosity, and to afford practical instruction to inquiring minds. The local members of the Committee on Conventions, Messrs. Shinn, Michaelis and Metcalf, have designated some of the works to be visited, and I have no doubt that all of us will be both pleased and instructed by the examination. I may safely say, for myself and in behalf of the Society, that we come here, not to instruct, but to be instructed.

Vice-President Roberts further said: It is customary that a member of the Society, not an officer, preside at all but the business sessions of the Convention, and he moved that Mr. William P. Shinn be made Chairman, which was carried. On taking his seat Mr. Shinn briefly thanked the members present for the honor conferred, and welcomed them to Pittsburgh.

The Secretary of the Society was made Secretary of the Convention. He presented the order of business as previously announced and set forth in the published "List of Topics,"\* each topic to be called for discussion in regular order.

\* Page 232.

The consideration of professional subjects was entered upon, and the first topic—"Bridges," called : under it, a communication on "Arched Bridges," from Mr. Squire Whipple, was read, and the following were discussed : "Draw Bridges," by Messrs. Ellis, Macdonald, Herschel and Clark Fisher ; "Foundations," by Mr. Collingwood ; "Erection of Structures," by Messrs. Maurice, Cooper, Steele, Charles H. Fisher, Ellis, Flagg and Collingwood, and "Bridge Accidents," by Messrs. Ellis, Boller, Steele, Metcalf, Shedd, Herschel, Thomas C. Clarke, Cooper and Macdonald.

The second topic—"Steam Engines and Furnaces"—was called : under it, Messrs. Roberts and Greene discussed the Report on "Pumping Engines,"—and communications relating thereto from Mr. James H. Harlow and E. D. Leavitt, jun., were referred to the Committee on Library.

The third topic—"Railroads"—was called : under it, "Railway Signals" were discussed by Messrs. Charles H. Fisher, Steele and Shinn, and a communication from Mr. Charles Paine was duly referred ; "Rapid Transit in large Cities," was discussed by Messrs. Thomas C. Clarke, Collingwood, Charles H. Fisher, Leverich, Steele, Cooke and Macdonald ; a communication relating to the latter, from Mr. Richard H. Buel was read, and further discussion of this and other subdivisions of the topic under consideration, deferred to subsequent sessions of the Convention.

The Chairman called attention to the programme prepared by the local members of Committee on Conventions, for excursions to points of interest, in and about Pittsburgh ; as for that afternoon, by horse-cars to glass, tack, spike, iron and crucible steel works, the open hearth steel furnace, diamond-toothed saw for cutting stone, and Alleghany pumping engine ; and for Wednesday, June 9th, by special train, to bar, beam and Russia iron mills ; Crescent and Bessemer steel works ; tube, bridge and coke works, the Lucy and the Dank's puddling furnaces, and the iron sponge open hearth steel furnace.

The names of members present were taken, and the Convention adjourned to meet in business session at 7½ o'clock p.m.

THE SECOND AND EVENING SESSION was called to order at 7½ o'clock, for the transaction of regular business ; Vice-President Roberts in the Chair.

Topic I. "Policy of the Society—Constitutional Changes" was taken up : it was considered in papers by Messrs. Boller and Richard H. Buel.

Mr. BOLLER'S paper substantially was :

Estimating from results and making due allowances for shortcomings, members have reason to congratulate themselves upon the measure of success that has attended their efforts to make the American Society of Civil Engineers the representative body of the profession and a power both at home and abroad. Its progress, from its new birth in the fall of

1867 to the present time, less than a decade, is a tribute to the wisdom of its management and the high aims of its founders.

While we point to the past with pride, we must not be content with "letting well enough alone," or misled with that false conservatism which regards change of any kind as the beginning of disintegration. So long as an ideal is before us we must push

forward with persistent effort, and year by year reduce the distance that separates us from that impossible perfection. To forecast the future wisely we must weigh carefully the experiences of the past, and in view of the discussions before us, time will be well spent in investigating the elements of the success to which I have alluded.

First and foremost, I believe that the root of our prosperity lies in the peculiar un-American idea of a "qualification for membership," which involves requirements sufficient to give the Society a strength of authority that nothing else could possibly do. From this springs the desire for membership that has resulted in a list of almost five hundred including the names of a major portion of the most prominent engineers in the United States, and not a few beyond its borders. While the sentiment of association under such circumstances is a strong one, yet without other satisfaction or vitalizing principle it is not reliable for a long continued drain in the shape of annual dues, and the printing and disseminating of professional papers was early instituted as a means of keeping alive the interest of a widely scattered constituency.

The manner of publishing these papers has undergone a radical change. From being infrequent and irregular in their issue, the "Transactions" of the Society have become a monthly publication, the original contributions to which, compare favorably with those of any other society of which I have knowledge. A notable result of the present system of issue, commenced as it was after a long and tenacious opposition to a change, has been that the original material offered by members is in excess of the capacity of the treasury to print. Formerly it was necessary to solicit members for papers: now the number offered permits a selection that elevates the value of our publications, and that value is perceptibly increasing.

A red-letter day in our history is the one when it was decided to institute the Annual Convention. It was in the weakly days of the Society, while it was still in swaddling clothes, when the treasury needed careful nursing, and the publications were issued irregularly. Members were tiring of the sentiment of association, with no communication from the Society but the Treasurer's annual circular. Applications for admission were rapidly falling off, and it was necessary that some method should be devised to bring members together for mutual acquaintance and social intercourse, or the ambitious efforts to establish a national society would inevitably re-

sult in a local club. What these Conventions have done for the Society would be a story that I could dwell upon; there is no event in its history with which members are more familiar. The occasion is looked forward to months before its occurrence, and the interest awakened is so great that a personal sacrifice of time and money is cheerfully made, which even the annual meeting for the election of officers does not call forth. And yet, strange to say, the Constitution of the Society recognizes in no sense whatever this life-giving element of its prosperity. In passing, I could not omit to note that the fact of a paid Secretary grew out of the Chicago Convention, a measure of wisdom, the progressive effects of which, day by day, cannot well be overstated.

The establishment of the "Fellowship Fund" must be referred to as a happy conception, and successful in its results, although a little more individual effort would have largely increased the benefits resulting therefrom. Not only is this fund the means of augmenting the wealth of the Society, but it also brings together the agents of modern civilization—the engineer, the constructor and the capitalist: and it must be conceded that the greater the harmony between these elements of material prosperity, the more satisfactory that prosperity will be.

An innovation upon established custom, and one of the prominent marks of progress, was the introduction of the letter-ballot. By means of it, all members, no matter where situated, have the privilege of exercising a voice in determining who shall be admitted to the Society. Surely no argument is needed to prove that if this method were generally applied to other affairs of the association, its influence, as a body, upon the individual members, would be greatly increased.

That the Society is rapidly attaining a position of national importance is evidenced by the fact that the General Government named from it the civil members of the commission appointed last fall to visit Europe and report upon the jetty system, as there applied. Further, the passage through Congress of an act authorizing the formation of a government commission to experiment on the strength of American materials of construction, was due almost entirely to the efforts of this Society. On this commission, at the request of the President, the civil members were named by the American Society of Civil Engineers. These facts will materially aid the Committee on National Recognition. Under American institutions, it is hardly possible to frame any more practical method of national recognition

of a body like this than that of influencing legislative matters affecting the profession. Its object is to elevate and conserve.

The "Norman Medal" must not be overlooked in this rapid review of the past, since its stimulating effect upon original research and careful and accurate work has borne fruit, in this the first year of its existence, in two elaborate essays by Messrs. Herschel and Croes, which it is safe to say would never have been called forth excepting through the laudable rivalry attached to such a mark of distinction.

I have thus hastily passed what may be called the milestones in the Society's career of progress, and even the most conservative must admit that they mark a decided success. However, the results thus shown have not been attained without a vigorous opposition. The measures that have so energetically quickened the life of the Association have not been passed hastily and without thorough discussion. The tendency "to make haste slowly" in all innovations upon established custom, is a great shield against illy-considered legislation. For one, I shall always be glad to see every measure of progress introduced into this Society, fought step by step, even if thereby a year or longer is spent in arriving at a conclusion, for then, when the result is finally reached, we shall feel assured it is for the best interests of the Society.

The growth of the Society is certain so long as its members feel an individual responsibility attaching to their membership. Any change of policy, therefore, can best be carried out by curtailing the power now exercised by resident members at the regular meetings, extending the letter-ballot system, and remanding all questions affecting the Society as a body, to the Annual Meeting and the Annual Convention, the two occasions in the year when special effort is made by members to be present. It is certainly an anomaly, as matters now stand, for seven members to constitute a quorum to transact business and pass resolutions binding nearly five hundred, and liable to great abuse. In my judgment, but routine business should be undertaken at the regular meetings of the Society. It will be good policy eventually to change the whole character of these meetings, and simply hold them for the discussion of professional topics, leaving all business matters to be arranged twice a year, with the Board of Direction as an executive body to administer the everyday affairs of the association.

The change of headquarters in the city of New York, from down-town to the neighbor-

hood of the Fifth Avenue Hotel, was a move made largely in the interest of the non-resident members, and is a step toward realizing the mode of government just outlined. It is intended that the new rooms shall be open in the evenings, and their location is such as to make them convenient gathering places at that time, when city and visiting members can feel the freedom from business pressure that so interfered with the meetings held in the afternoon, as was necessitated by the downtown location of the old quarters. The ideal set forth by Mr. William J. McAlpine, in his address on assuming the chair after election as President of the Society in 1868, may now be more nearly approached. This address is so elevated in tone and suggestive of aims to be attained, that I refer to it, trusting some will be tempted to its re-perusal.

During the past year, the policy of appointing committees for special investigations has been brought prominently before the Society by the appointment of the committee on "Rapid Transit:" which appointment, or rather the resolution under which it was made, is a pointed argument for curtailing the power of the regular meetings. This resolution was thoughtlessly worded, and not only instructed the committee to investigate the problem of rapid transit, but also to report plans, thereby requiring an amount of work that none but a well-constituted and enthusiastic committee would have undertaken. The work was accomplished in an excellent manner, as is universally conceded. As you are well aware, the "report" of this committee was not received as such by the Society, but as a "paper" from the subscribing members. A majority of those present at the meeting when such action was taken, felt that able and conscientious as was the report, if it were formally received,—a dangerous precedent might be established, for the appointment of special committees not only to investigate principles and collect facts, but also to recommend plans, whereby the influence of the Society could be used to further selfish schemes, particularly since a quorum of seven members at a meeting might accidentally be of one mind. It was held that the preparation and recommendation of specific plans and measures was a matter of individual practice, and that the Society should not be transformed into a bureau of free professional advice.

In this a principle is involved, and one which should early be set at rest. The wisdom of collecting information through the medium of special committees appears in some of the best work the Society has done.

Work is accomplished by such committees that never would be undertaken otherwise, and sources of information quite inaccessible to the individual are thrown open. It is necessary—as recent experience has demonstrated—to define the general limitations of committee work. In my judgment, it is neither wise, nor was it contemplated by the founders of the Society, to commit it to any special schemes, or in any way to interfere with private professional practice. The knight of La Mancha's philanthropy would pale before that of this Society, did it hold in readiness peripatetic committees, to straighten out the engineering difficulties, that more or less beset municipal corporations. I am sure that no member desires to be placed in such a Quixotic position, but any tendency that way can be effectually checked by referring all resolutions proposing new business to the Board of Direction, which should be required to examine and report to the Society, at some future meeting, what action in regard thereto is permissible under the Constitution. Such a procedure would take time. It has been said "that seven years are required for an idea to take legislative shape," and in this, as in similar cases, it is true that deliberation is the best safeguard against crude action.

Hitherto, the Transactions of the Society have been copyrighted, which technically means the exclusive right of publication under a law for commercial purposes, instituted for the protection of authors and publishers. As the Society does not issue its Transactions as a source of revenue, either for itself or writers of papers, there is nothing really gained by copyright, and it should be abandoned as antagonistic to the spirit of American institutions. There is something puerile in the idea of exclusive knowledge, and the argument that abandonment of copyright would result in unauthorized publication in scientific journals—which being obtainable at less cost than that of membership, would effect a diminution in the roll of members—pre-supposes a lack of spirit and appreciation of the benefits of association, inconsistent with Article II of the Constitution, and the character of the men whose membership the Society should covet. Broadly, the mission of the Society is the collection and diffusion of knowledge of a special kind, and its public importance cannot but be greatly enhanced by the far-reaching circulation of the general prints. If the Society is ever to occupy the position of an engineering authority in the country, that authority must be conferred upon it by the employing public. Self-assertion cannot do it, and as the public does not come to us, we

must go to the public, using every legitimate means in our power to acquaint it with the character of our work and our aspirations. Throw open, then, the doors for a wide dissemination of the results of our labors, and let him benefit who will. Depend upon it, the advantage will be upon the side of the Society and of American engineering.

Much has been said in certain quarters about making the meetings of the Society public, principally on the ground that the attractions of larger audiences would induce members to put forth special efforts in the preparation of papers, and that additional interest would be developed in the discussions. It is vital to harmonious working and the reputation of the Society, that it should rigidly maintain an independent and dignified position. The opportunity for scheming and unscrupulous parties to make use of its influence for selfish purposes, were publicity given to the meetings, is sufficiently dangerous to cause the rejection of such a policy as unwise in the extreme. While conceding a public side to the Society, we must not lose sight of its private character, and that a certain amount of exclusiveness is necessitated by that dignity which befits the honorable title "Member of the American Society of Civil Engineers." There is an element in the American character, born of democratic notions, on which the very idea of quality or exclusiveness has a very irritating effect, and to an aristocracy of any kind, professional or social, it has the most repugnant feelings. Such an element it is neither desirable to avoid nor to conciliate. Article I. of the Constitution constitutes us a professional aristocracy, and thereby confers a rank, which I trust will forever be jealously guarded. On occasions when no business is to be transacted, there can be no impropriety in permitting members to invite friends who may perhaps be interested in listening to a paper and its discussions. But that a general invitation to attend the meetings should be extended to the public, is manifestly improper, and inconsistent with all ideas of sound policy. There are occasions, however, when I think the mingling of members and non-members, under Society auspices, would not only be perfectly proper, but advantageous; I refer to professional receptions, which the capacity and location of our new rooms in New York will permit of our undertaking, thus adding one more tie to those that bind us.

In conclusion, I think we agree that our past experiences have shown our constitution to be not yet a perfect instrument, and that it re-

quires additions and changes to meet new questions. It is probable that slight modifications may be made to cover future emergencies, and I trust the discussion this evening will result in the passage of some resolution looking toward the early adoption of what is required.

Mr. BUEL's paper was as follows :

The writer must confess to so little familiarity with the practice of the Society, that the manner in which the report on Rapid Transit was received, at a regular meeting held February 3d, 1875, was a great surprise to him, as he had the idea that the principal object of the Society was to make investigations and express opinions. It is hardly necessary to state that the general tenor of the remarks made, on the occasion of the meeting referred to above, were decidedly adverse to such an idea, and the writer now is quite ready to admit that he may have been mistaken. Probably every one will agree that it is desirable to have the policy of the Society clearly defined by some more decisive expression of opinion than that of a resolution passed by a few resident members. The following resolution has therefore been prepared for the consideration of the Convention, and should action therein proposed be taken, it will doubtless determine the views of the majority beyond dispute. As these resolutions are intended to call out a vote, not merely the individual opinion of each member who is sufficiently interested to respond, they are supposed to be applicable to all members without distinction of class.

In order to ascertain the opinions of the members of this Society, in regard to the appointment of committees to make special investigations, and the proper disposition to be made of reports :

Resolved—That the Secretary is hereby instructed to forward to every member of the American Society of Civil Engineers a circular in accordance with the draft given below, together with this preamble and resolution; that the replies, so far as received, be announced at the next regular meeting of the Society; that replies received after the next regular meeting be announced at subsequent regular meetings, and that records of the individual opinions of the members so obtained be published in the proceedings of the Society in regular course.

AMERICAN SOCIETY OF CIVIL ENGINEERS,  
New York, 1875.

DEAR SIR,—In accordance with the foregoing resolution passed at the Seventh Annual Convention of the Society the following questions are sent you. You are requested

to answer them, by affixing "Aye" or "Nay" to each, in accordance with your opinion, and to return the paper as soon as possible, with your signature attached.

(Signed), .....

Secretary.

First—Do you consider that the Society should appoint committees to report on local engineering matters?

Second—Do you consider that the appointment of a committee to prepare a plan for rapid transit in New York, was unwise?

Third—Do you consider that the Society, as a body, should express opinions in regard to any local engineering matters?

Mr. HARDING, said: I understand a committee was appointed, under a resolution, to take such action, and to make such report in regard to rapid transit in New York, as that resolution called for. As it is generally conceded by members that this report was rendered in a highly satisfactory manner, is it not in rather bad taste now to criticise and discuss actions which refer not only to the makers of the resolution, but to a certain extent also reflect on the members of the committee who performed their work so admirably? The resolution was passed, the report has been accepted; is it necessary at this late day, to bring them up, because, for a cause unknown, some persons are not suited?

Mr. BOLLER said: It is not intended to criticise the committee on Rapid Transit or the report, but it is important that the principles which underlie the appointment of this and other special committees should be established, and the defects of laws of the Society in this respect pointed out and remedied.

Mr. COOKE said: The report on Rapid Transit should not be referred to in connection with the discussion of changes to be made in the Constitution. The question is, whether it is desirable to introduce a feature therein forbidding reports of that character; the opinion is general, even with those who most opposed the report, that it does honor to the Society, and should be spread on its records. But there has been a fear, that the reception of such reports would open a door in the future for evils which could not then be remedied.

I believe the Society will be more successful in its efforts if committees are restricted to subjects of a general character, bearing upon our profession, without taking up details which may interfere with the individual business of members. Engineering is our profession; our plans are our property, and each member may have plans of a



practical character which will be seriously affected by a report of the Society upon local improvements; while, therefore, I hope that action will be taken in the matter, I am sure that Mr. Buel's second question should be stricken out. We may well inquire of members whether it is best to discuss such questions, but we ought not to ask if they think this is a proper report on Rapid Transit. We have nothing to do with that now, and it would be discourteous to the committee to put such a query to members of the Society.

A committee very properly may be appointed on rapid transit, and make a report substantially as this one; but the point is—under the resolution detailed plans were to be presented, and the reason why, in the minds of many, there was feeling on this subject, was, that it was supposed for a long time, that from the plans submitted to the committee, the best was to be recommended to the Society for adoption. The report was almost entirely free from such objection, but the impression had gone forth, not only in the Society, but throughout the community, that this committee was thus to set the whole question at rest. While no such thing was, or should be done, it is to guard against the possibility of so doing that a change in the law of the Society is desirable.

Mr. CHARLES H. FISHER said: The fact cannot be ignored, that a resolution was adopted for the appointment of a committee on Rapid Transit, the committee was appointed, and a

report made. This discussion—at least the action that is now proposed—has grown out of that report. The meaning of the term "local" in Mr. Buel's first question, is not clear. If the resolution under which the committee on Rapid Transit was appointed had been properly worded, the subject would not have been local, and could not be so considered by the Society. If simply the best conditions for successful rapid transit in New York were to have been considered, I think it would have been entirely proper, and I believe that there may be other subjects, in other cities, which will be considered in the same way. If, for instance, it was an engineering problem, how the water-power of Niagara Falls could be utilized, and it was a question among the public generally what would be the proper course to pursue, the Society might appoint a committee of its members to make necessary investigations, and report without specifying a particular plan, and the information thus obtained would be valuable not only to the Society, but to the local engineer put in charge.

Mr. MACDONALD said: To bring the matter before the Society in proper form, I move the adoption of the following resolution, wherein the question of what has been done, or action taken on a previous report is eliminated, the resolution being general, will draw forth an expression of opinion from the members of the Society, which will indicate definitely what should be its future policy in this regard.

Mr. Macdonald moved: That the Secretary be instructed to issue a circular to members of the Society, containing the two following questions, to which answers shall be requested; the answers to be published from time to time, in a condensed form, in "Proceedings"—whereby a continued investigation of the subject will result:

First—Do you consider the Society would be benefited by adopting the policy of appointing committees for the purpose of reporting upon engineering subjects, whether of local interest, or otherwise?

Second—If yes, under what restrictions do you consider such committees should be placed, and what action should be taken by the Society on their reports?

The motion was seconded by Mr. Charles H. Fisher.

Mr. COOKE said: Without doubt, wisely the Society may appoint committees upon engineering questions, both local and general, but there are local questions different from those already referred to—questions which may involve the determination of plans, and interfere with the individual business of members. Thus the consideration of the bridge question in reports on Bridge Accidents has nothing to do

with the adoption of plans; but merely to find out where are the defects of plans that have been adopted, tried and proven to be faulty. Therefore I think Mr. Macdonald's first question should refer to the appointment of committees upon subjects which do not involve the preparation of plans and their being carried out.

Mr. STEELE said: Within the last eighteen months a dam was washed away in Massa-

chusetts, and a committee appointed by this Society to investigate the cause of the disaster. Was not that as much a local matter as rapid transit in the city of New York, and yet no objection was made to the report which was duly presented. It seems to me that the difficulties which surrounded the reception of the report on Rapid Transit are local, while the thing itself has a general interest. For one, I am confident that the good sense of the American Society of Civil Engineers will prevent any meddling with local matters, or matters of partial interest. I cannot see that there is occasion to move in this matter merely because local objections in New York have been urged against this rapid transit report, which have not been raised in any other instance where committees were appointed to make investigation, although in relation to questions quite as local in their character as this.

Mr. BOLLER moved, as an amendment, which was seconded: That a committee be appointed to prepare and report to this Convention the questions affecting the policy of the Society, proposed to be asked of members.

Mr. THOMAS C. CLARKE said: The trouble in this case of rapid transit seems to have arisen from the fact that the committee was appointed at a local meeting of the Society, at which a very few members were present. If the Society were to reserve to itself the appointment of committees in Annual Convention, or Annual Meeting, this could not arise, therefore I move—

That no committees be appointed by the Society except in Annual Convention, or Annual Meeting, and under such restrictions as the Society shall then determine.

Mr. CHARLES H. FISHER said: Perhaps the wisest action in these matters would be to allow each particular question to be settled as it came up. Thus, if a member has a particular subject of local interest upon which he wishes the collective opinion of the Society, let him ask for the appointment of a committee under a By-Law; or, if necessary, an amendment to the Constitution, allowing, at request, the appointment of a committee in similar cases, all of the members to be notified thereof by the Secretary, and no special committees to be appointed except in this way.

I am opposed to Mr. Clarke's resolution

Mr. ELLIS moved, which was seconded: To lay the whole matter on the table, that such changes in the By-Laws as seem desirable to members may be proposed and considered.

Mr. Macdonald's first question covers the ground, whether the Society shall appoint committees at all, or not, and is one on which all the members will vote in the affirmative, and therefore it will be unnecessary to ask it. The second question is so general that as many different opinions will be given as there are members, hence no conclusion will be reached; and therefore if questions of this kind are to be asked, they should be put in a more concise form, so that something may be determined from the answers rendered.

Mr. MACDONALD said:—In the second question is expressly stated under what conditions such committees should be put; the answer to that will cover the first difficulty, because in the reply it would be stated that such committees should be confined, for example, to the collection of that general information upon topics as would not interfere with individual efforts in the formation of plans by members.

because it will take too much time. There may be a case of emergency where one would like information as soon as he could get it, which may be reached by letter ballot as well as to wait for the Convention or Annual Meeting.

Mr. THOMAS C. CLARKE said: If there is a subject upon which the Society or engineers desire information simply, a committee might be appointed to investigate and report facts without expressing opinions.

Mr. MONROE said: Attention is called to one thing in Mr. Clarke's resolution,—when a member dies, a committee cannot be appointed until the next Convention or Annual Meeting.

Mr. ELLIS said: The appointment of a committee and the asking of these questions of members of the Society will bring out many conflicting opinions. The majority of the Society, at least of non-resident members, agree substantially with what is set forth in Mr. Boller's paper. A definite amendment to the Constitution and By-Laws will cover the case, and an attempt should be made to obtain the opinions of the members on that change, and not answers to questions in regard to which few of us are agreed.

Mr. HOLLEY said: I favor the amendment of Mr. Boller; it is better to refer this matter to a committee to consider and advise a proper remedy; the Society may then discuss and adopt something that will meet the contingencies likely to arise.

THE SECRETARY said: I desire to call attention to these facts. At a regular meeting of the Society, February 3d, when the report on Rapid Transit was under consideration—the following was proposed as an addition to the By-Laws, seconded, and action thereon set down for March 3d.

Section 31—No special committee shall be appointed except on written notice given at a previous regular meeting of the Society.

This proposed By-Law was referred to the Board of Direction, which in due course referred it to the Secretary, to report how far it would affect the transaction of the business of the Society, and he has not yet reported.

Another fact is, that the Conventions of this Society are not regarded in the minutes or on the records, as regular meetings—at which business may be transacted. That position has been generally held, and a reference to the Constitution will show that Con-

ventions are nowhere recognized in the organic law of the Society.

Mr. THOMAS C. CLARKE said: If that is the case, I withdraw my resolution.

Mr. MACDONALD said: This is a business meeting; why not as a committee of the whole take up this matter at once, and settle it. In the course of discussion, if any one has a question to suggest, it could be considered and then a definite plan be adopted, which will cover the whole case.

Mr. BOLLER said: This is a matter of vital importance, and we should go at it deliberately, even if a year is spent; the agitation of the question during that time would result in limiting committee work generally. Hasty action should not be taken;—it is better now to talk, give reasons and set in motion the machinery which in time will fully accomplish the desired results.

Mr. ELLIS said: My purpose in making the motion I did, was to give to any member who wished, an opportunity to suggest amendments in the Constitution and By-Laws, and to turn the discussion from the question of rapid transit to a consideration of what changes are necessary in the law of the Society.

The question being called, the resolution offered by Mr. Ellis was put and carried. The amendment offered by Mr. Boller was, on motion of Mr. Cooke, taken up as an original resolution.

Mr. HERSCHEL said: I suggest that this Committee take into consideration such amendments of the Constitution as will make the Annual Convention a business meeting, or at least a regular meeting of the Society.

Mr. BOLLER said: The resolution is in very good shape now. It is proper to appoint a Committee with instructions to revise the Constitution and wipe out the crudities that exist in it. The committee will probably take in all the points and suggest such amendments as are in accordance with the progressive character of the Society. That a quorum of seven may come together in New York and legislate for nearly five hundred, is, I think, an anomaly, which should be wiped out speedily.

Mr. ELLIS said: I think there is on the record some action making Conventions a business meeting of the Society, which followed a discussion of the matter at the Chicago Convention, where it was decided adversely. I think this is a legal business meeting.

Mr. SHINN said: I raised the question there

The resolution was amended, and finally adopted as follows:

Resolved,—That the paper of Mr. Boller be referred to a Committee

and offered the following amendment to the Constitution: "The Annual Convention of the Society shall be competent to act upon any business of the Society, including any amendment to the Constitution or By-Laws; provided that the Constitution shall not be so amended by a vote of less than thirty Members in the affirmative, which affirmative vote shall not be less than two-thirds of the Members present."

The amendment was referred with several others to the Committee on Chapters, which got into such deep water that this particular work never came to the surface. In the discussion at that time, this article of the Constitution was cited as conclusive.

Article 32—"The permanent place for the transaction of the business of this Society shall be in the city of New York."

That refers to the permanent offices of the Society where its general business shall be done, and does not mean that no business can be transacted elsewhere. I think we are entirely in order to act on these questions to-night, or at any adjourned meeting agreed on.

of three, consisting of one resident and two non-resident members, to report as soon as practicable before the final adjournment of this Convention, upon the matters therein discussed, and recommend such action as may be deemed advisable.

The Chair appointed Messrs. Holley, Ellis and Thomas C. Clarke as such Committee, which then retired.

MR. COOKE said: We have heard Mr. Boller on the success and progress of the Society. In the few years it has been in existence, it has acquired a high name. It is held in respectful esteem, and recognized as a power in our own and other land. But as yet, it has no permanent home. It is true, the rooms in the city of New York, the headquarters of the Society, are very desirable and pleasant, but they are altogether insufficient for the future needs of the Society. The library is increasing in value and extent every year, and if there were any means of preserving and placing them where they could be examined, plans, engravings and models of exceeding value would from time to time be presented. We should early think of some means by which may be preserved what the Society now has and what it may acquire in the future. A building should belong to the Association, devoted exclusively to its uses. How that can be accomplished is a very important question. I believe that the time will soon come, when a place will be had where not only engineers from our own country—but also from abroad—can resort and obtain valuable information. Should not initiatory steps be taken by this convention toward that object. It may, and probably will be distant, but there must be a beginning. In our membership are gentlemen who are able, and I doubt not, willing

to aid in such an enterprise, and with becoming effort we may expect in a reasonable time to see substantial progress in that direction.

THE CHAIR said: A committee of the Society, of which I am a member, charged with that duty, has been acting for months; it has conferred with committees from other societies, and fully discussed the subject, with a view to secure an eligibly located, convenient fire-proof building, which shall furnish permanent quarters for the scientific associations of New York. Propositions have already been received from capitalists looking toward the erection of a building for this purpose. Having this in mind, the lease of the present quarters of the Society was taken for but a short term.

MR. MONROE said: There is in Chicago an association known as the Civil Engineers Club of the Northwest. Does this Society exchange papers with it?

THE SECRETARY said: This Society at the present time exchanges with every engineering society on this continent, speaking and writing English, and with nearly every one in Europe, and with societies of engineers in France, Germany, Austria, Spain and Portugal. The Civil Engineers' Club of the Northwest was, I think the first engineering association in the country to extend to this Society the right hand of fellowship.

Topic II—"Increase of Associate and Fellow Membership, and of the Society's Funds," was taken up:

MR. COLLINGWOOD, said: I may remind the members present, that removal of headquarters to new rooms has added considerably to the expenses of the Society, and that because of the quantity to publish, "Transactions" are costing quite the amount estimated. It is desirable that all good persons whom the members can bring in should be added to the Society.

MR. SHINN said: That this is a matter vital to the success of the Society, will be conceded by every member. At the Chicago Convention it was brought under discussion by the reading of a paper by Mr. Boller, on the subject of the Fellowship Fund. I offered a resolution, which was passed, that each member then and there present use his best effort to

procure at least one additional Fellow within the year. I do not know how many were obtained, but I secured two. My experience in this matter has been substantially that it only requires a little personal effort. All of us know one or more engineers who would be an addition to the Society, not merely on account of annual contributions, but because they would give increased zest to the meetings, contribute information to the discussions, and add importance to the Society. Further, we all know one or more, some of us many persons, interested in the subjects discussed before the Society, who are not eligible as Members, but would willingly subscribe to the Fellowship Fund, if the matter were efficiently presented to them.

Subscribers to this fund are contributors to the success of the Society. They are persons who unite with the association to obtain for themselves its advantages and benefits, and the amount of contribution which constitutes them Fellows is not of more value than they are likely to receive in return. I have before mentioned the instance of a manufacturer in this city, who subscribed to the Fellowship Fund when the fee was \$100; he said that the information obtained from the first or second paper sent him, more than repaid the cost. I have no doubt that with a proper personal effort of members, in presenting the subject to engineers and to men owning or controlling large works, great accessions could be made to the membership. It is only necessary that each for himself shall resolve the addition shall be made, and it will.

Mr. COLLINGWOOD said: I understand the principal advantage of being a Fellow of the Society is to receive a copy of Transactions; if, as proposed, copyright on the Society's publications is abolished, would not this advantage be lost, as the same papers could be had through the public prints?

Mr. BOLLER said: I have had experience in obtaining Fellows of the Society, and my impression is that receipt of Transactions is only a secondary matter; if we can make the publication valuable, so much the better, but the primary object of being a Fellow is to be associated with engineers.

Mr. MACDONALD said: In reference to the qualification of a Fellow, the views of Members should be expressed. It is desirable to know what a Fellow should be, that is, what position he should occupy with reference to the Society. Many men who come in contact with engineers, and are under their control in the execution of work, as, for instance, contractors pure and simple, would doubtless become Fellows, that thereby they could have a standing with engineers not possible otherwise, and it is for Members to express

Mr. HOLLEY, Chairman of Committee on "Policy of the Society," reported as follows:

Resolved, that this Convention recommend the following amendment to the By-Laws:

Special committees to report on engineering subjects shall only be authorized by a majority of the votes cast by the Society, either in Annual Convention, at the Annual Meeting, or by letter ballot.

On motion the report was accepted, and the Committee continued.

Topic III.—"Establishment of an Engineering Library," was presented by the Secretary, who called attention to the report thereon, offered May 12th, and on behalf of the Committee asked the co-operation of members, in effecting the objects in view.

On motion the report was accepted, and the Committee continued.

an opinion whether men should thus be admitted, who would simply come in to strengthen themselves and carry out their own schemes. All the qualifications specified for a Fellow is that he shall be an acceptable subscriber to the funds of the Society, who has signified to his proposers a desire to be nominated, and an intention, if elected, to become a member of this class. To be sure, he has to be voted for, and we have the veto power in the Society; but unless there is a definite expression of opinion as to whether the class I have mentioned should be admitted, I would not feel like voting adversely, on this ground alone.

Mr. COOKE said: As a Fellow cannot vote, he cannot make reputation for the Society, nor can his connection be detrimental to it in the proper discharge of its functions. If there is no moral objection to the proposed member, I see no other; he can give no tone to the professional and official character of the Society.

Mr. CLARK FISHER said: After all, the object of the election of Fellows appears to be this: it is a means of obtaining money for the Society. There are some who have this yearning, a desire to be among scientific men, who will gladly pay \$150 to be with us, go on excursions and attend our meetings. To rely on getting in men in this way to pay annual expenses will not support the Society. The method is too insecure and insufficient.

Mr. BOLLER said: Taking in view the object of Fellowship, as expressed in the Constitution, I do not see that we can require any other record of Fellows, than to show they are honorable men. Their motives, or the nature of their business cannot be inquired into. The object of the fund is to provide a permanent sum for the publication of Transactions; the principal to remain intact, and the interest only to be used. I am informed, that up to this time, even the latter is untouched.

Topic IV.—“National Recognition of the Society” was taken up—a report from the Committee thereon was read and accepted, and the Committee continued.

Mr. Shinn offered the following, which, on motion, was referred to the Committee on “Policy of the Society:”

Resolved, that this Convention recommend for adoption the following By-Law:

A convention of the Society for professional discussion and social intercourse, shall be held annually, at such point as the Society may determine, and be presided over by a chairman selected from among members, not officers of the Society; during the Convention, a business meeting shall be held, when the business of the Society may be transacted; said meeting to be held as a regular meeting of the Society.

On motion, the Convention adjourned to meet again in business session at a time to be fixed on Thursday, June 10th.

THE THIRD AND MORNING SESSION was called to order Thursday, June 10th, at 10 o'clock, for the consideration of professional subjects. Mr. Shinn in the chair.

Under the third topic, in conclusion, the following were discussed: “Rails,” by Messrs. Holley and Metcalf; “Rapid Transit in large Cities,” by Messrs. Searles, Steele and Emery; “Cheap Freight Transportation,” by Messrs. Shinn, Roberts, Collingwood, Herschel, Steele and Holley, and “Railway Systems Contrasted,” by Messrs. Slataper, Shinn and Roberts; a communication on “Cheap Freight Transportation,” by Mr. Wilson Crosby, and one on “Rails,” from Mr. Walton W. Evans were read, and sections of the Stevens T rail, described in the latter, were exhibited.

Under the first topic—“Bridge Accidents,” were again taken up, Mr. Macdonald offered the following:

Resolved, that the standard of loading for bridges and stresses on material as indicated in the revised report of Messrs. Eads and Smith\* be adopted, and that a committee of three be appointed to report at as early a day as practicable, on the advisability of securing legislation in the premises; and if yes, to submit the draft of a law which may be recommended to the several State legislatures for adoption; the report to be printed in Transactions and acted on by letter ballot.

Mr. Macdonald explained that the revision of the report of Messrs. Eads and Smith alluded to in the resolution, was the substitution for the second table therein† (that giving the uniform distributed moving load for different spans of railroad bridges); the second table‡ of the report by Messrs. Boller and himself. After discussion by him, and by Messrs. Briggs, Ellis, Steele, Searles, Herschel and C. Shaler Smith, action on the resolution was postponed to the business session.

During the discussion, recess for 1½ hours was taken, and the Convention was again called to order at 2½ o'clock P.M.

\* Transactions, Vol. IV, page 122.    † Ibid, page 124.    ‡ Ibid, page 132.



The fourth topic—"Strength of materials," was taken up; under it—relating to "Tests and Testing Machines," Messrs. Holley, Macdonald, C. Shaler Smith, Emery and Metcalf discussed "Tests of American Iron and Steel;" a paper by the latter on the "Uses of Steel in Construction," and a report on a "Testing Laboratory," by Mr. O. Chanute, Chairman of Committee, were read; and relating to "Theory of Flexure," communications from Messrs. Louis Nickerson, John G. Barnard, De Volson Wood and Robert H. Thurston, were duly referred.

The fifth topic—"Rivers and Reservoirs," was taken up; under it a paper by Mr. G. W. R. Bayley on "Levees" was duly referred; "River Mouths" were discussed by Messrs. Roberts, Ellis and C. Shaler Smith, and a communication from Mr. Henry D. Whitcomb was referred. "Rainfall and the resulting Water Supply," and "Gauging of Streams" were discussed together by Messrs. Shedd, Roberts, Ellis, Rotch, Croes and Joseph P. Davis, and a paper on the "Consumption and Waste of Water," by Mr. James H. Harlow, was referred.

The sixth topic—"Masonry," was taken up, and Mr. Shedd spoke upon "Cements and Concretes." Communications as follows, relating to this and the final topic were duly referred: on "Masonry Dam" and "Prices adopted by the Granite Stone-cutter's Association of New York," from Mr. W. W. Maclay; on the "Construction of a River Wall at Canal street, New York," from Mr. John D. Van Buren, jr., and on "Fires in Coal Mines," from Mr. Martin Coryell.

On motion, the thanks of members of the Convention were tendered to the Select Council of the City of Pittsburgh for the use of the Council Chamber for the meetings of the Convention—to the Alleghany Valley R. R. Co. for the invitation to make an excursion to the oil regions, and to Chatauqua Lake, with transportation thereto; to the Associated Pipe Lines, for the invitation to be their guests during the visit to the oil regions; to Messrs. Miller, Barr & Parkins, and Carnegie Brothers & Co., for hospitality, and to the Alleghany Valley, the Pennsylvania and the Pittsburgh & Connellsville Railroad Companies, and to their respective superintendents, for the use of special trains over their lines on the excursion of Wednesday last; to the several railroad companies, whose courtesies extended to members rendered possible the satisfactory attendance had at this Convention; to the several manufacturers, whose invitations to visit their works contributed largely to the enjoyment of members present; to Mr. William P. Shinn, for the able and courteous manner in which he has presided over the deliberations of this body, and to him and the other local members of the Committee on Conventions for the prompt and complete arrangements made for the entertainment of members during their visit to Pittsburgh.

Mr. Shinn returned thanks, and the Convention adjourned to meet in business session at 7½ o'clock P. M.

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Under this head will be announced new books on these and kindred subjects published in English, French and German, which may be professionally useful to members of the Society.

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- Steam Engine Indicator, Treatise on Richards' —. Charles T. Porter. London. 8vo. (*Van Nostrand, New York*.) \$2.50.
- Storms: their Nature, Classification and Laws, with the Means of predicting them by their Embodiments, the Clouds. William Blasius. Philadelphia. 12mo. *Porter & Coates*. \$2.50.
- Sun and Earth. Balfour Stewart; and Force electrically exhibited. J. W. Phelps. Boston. 12mo, illus. *Estes & Lauriel*. \$0.25.
- Tables, useful —. Compiled by Capt. W. H. Noble. London. 24mo. (*Van Nostrand, New York*.) \$0.25.
- Telegraph Construction. Manual of the Mechanical Elements of Electric Engineering. J. C. Douglas. London. 8vo, illus. (*Scribner, Welford & Armstrong, New York*.) \$6.50.
- Water Supply. Report upon the sanitary Chemistry of Waters, and Suggestions with regard to the Selection of Water Supply of Towns and Cities. C. F. Chandler. Cambridge. 8vo. (*Van Nostrand, New York*.) \$0.30.
- Works, for the Supply of Cities and Towns. Samuel Hughes. Rev. and enl. (Weale's) London. 12mo, illus. *Lockwood & Co.* 4s.
- Wedgwood Hand-book: a Manual for Collectors, treating of the Marks, Monograms and other Tests of the old Period of Manufacture, also including the Catalogues, with Prices, obtained at various Sales; together with a Glossary of Terms. Eliza Meteyard. London. 12mo. *Bell & Sons*. 10s. 6d.
- Year Book of Facts in Science and the Arts for 1874. ed. by Chas. W. Vincent. London. 12mo, illus. (*Van Nostrand, New York*.) \$1.25.

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Annual Reports, City of Somerville, 1874. Boston, 1875.
- of the City Engineer. Somerville, for 1874. Boston, 1875.  
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Sixth annual Report of the Massachusetts Bureau of Statistics of Labor. March, 1875. Boston.
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- From F. V. Hayden, U. S. Geologist in Charge, Washington, D. C.:  
Bulletins of the United States Geological and Geographical Survey of the Territories. Second series, Nos. 1, 2 and 3. Washington, 1875.  
Meteorological Observations made in 1873-4 in Colorado and Montana Territories. George B. Chittenden. Washington, 1874.  
Reports of Geological Surveys of the Territories, 1867-'73, by F. V. Hayden. 4 vols. Washington.
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Minutes of Proceedings, Session 1874-5, as follows:  
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Erosion of the Bore in heavy Guns and the Means for its Prevention, with Suggestions for the Improvement of muzzle-loading Projectiles.  
Origin of the Chesil Bank and the Relation of the existing Beaches to past geological Changes, independent of the present Coast Action. Joseph Prestwich.  
Petroleum and other Mineral Oils applied to the Manufacture of Gas. O. C. D. Ross.
- From Institution of Mechanical Engineers, Birmingham, England:  
Proceedings. Oct., 1874. Birmingham.
- From Moses Lane, Milwaukee, Wis.:  
Milwaukee Water Works; Report of Board of Water Commissioners. 1874.
- From Charles P. Leland and Charles Paine, Cleveland, Ohio. One copy each.  
Fifth annual Report of the President and Directors of the Lake Shore & Michigan Southern Railway Co. to the Stockholders for the fiscal Year ending Dec. 31st, 1874. Cleveland.
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Maritime Ports of France (French), with Maps.
- From William J. McAlpine, Albany, N. Y.:  
Report to the Secretary of State for India, in Council on Railways in India. 1859 to 1874. London. (Parliamentary.)
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Moments and Reactions of Continuous Girders. Philadelphia. 1875. 2 copies.
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Specimens of artificial stone.
- From Charles E. Paine, Providence, R. I.:  
Annual Report of the City Engineer for 1874. Providence. 1875.
- From Charles Paine, Cleveland, O.:  
The Lake Shore & Michigan Southern Railway; Report of Miles run by all Engine, Tender and Passenger Equipment Wheels moved during the year 1874.

From W. N. Radenhurst, New York:  
Specimens as follows: Department of Docks,  
Canal Street Section; Concrete Bulkhead  
Wall; Piece of Pile and Spike taken from  
Superstructure, Pier 42, North River.

From the Railway Association of  
America, St. Louis, Mo.:  
Transactions of the Association at its third  
annual Meeting, March 10th, 1875. St.  
Louis.

From Siemens Brothers, London:  
Siemens Brothers' Railway Bell Alarms and  
Telegraphic Apparatus.

— Railway Block Apparatus.  
From the Society of Engineers, Lon-  
don:  
Transactions for 1873. London.

From Spielmann & Brush, Hoboken:  
Specifications of Hudson Square Park Im-  
provement.

From Prof. Cady Staley, Schenectady:  
Circular and Catalogue of the School of Civil  
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1875.

From David A. Stewart, Pittsburgh, Pa.:  
Thirteenth annual Report of the President  
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From John G. Thompson, Columbus:  
Eighth Annual Report of the Commissioner  
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year ending June 30, 1874. Columbus. 1875.

From W. W. Wilson, Yonkers, N. Y.:  
Second annual Report of the Board of Water

Commissioners of the City of Yonkers. 1874.  
New York. 2 copies.

From Bennett Woodcroft, Clerk, Com-  
missioner of Patents, London.:  
Chronological and Descriptive Index of En-  
glish Patents applied for and granted from  
July 25, 1872, to May 13, 1874.

Patents for Inventions—Abridgements of Spe-  
cifications relating to—as follows:  
Air, Gas and other Motive Power Engines,  
1835-66.

Anchors, 1796-1866.

Closets,—Earth Closets, Urinals, &c., 1775-  
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Cooking Bread, Making and Preparation of  
Confectionary, 1634-1866.

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Locks, Latches, Bolts and similar Fasten-  
ings, 1774-1866.

Nails, Bolts, Rivets, Screws, Nuts and  
Washers, 1618-1866.

Pipes and Tubes, 1741-1866.

Safes, Strong Rooms, Tills and similar De-  
positories, 1801-1866. London.

Wearing Apparel, Head-Covering, 1637-1866.

From U. S. Coast Survey, Washington:  
Report of the Superintendent of the U. S.  
Coast Survey, showing the Progress of the  
Survey during the year 1871. Washington.

#### PURCHASED:

Specifications and Drawings of Patents issued  
from the U. S. Patent Office for August and  
September, 1874. 2 vols. Washington. 1875.

## ANNOUNCEMENTS.

**MEETINGS.**—The next *stated* meeting of the  
Society will be held Wednesday, June 16th, at  
8 o'clock P. M., for social intercourse and  
professional improvement.

The next *stated* meeting of the Board of  
Direction will be held Wednesday, July 7th,  
at 4 o'clock P. M., for the transaction of reg-  
ular business.

The next *regular* meeting of the Society  
will be held Wednesday, July 7th, at 8 o'clock  
P. M., when ballots for members will be  
canvassed, a reply by Capt. James B. Eads  
to the discussion in May Transactions of Mr.  
Samuel H. Shreve on "Upright Arched  
Bridges," presented, and other matters taken  
up. The formal session will close at 9 o'clock  
P. M., after which an hour will be given to  
conversation and social enjoyment.

No regular or *stated* meetings of the Society  
will be held from July 7th to September 1st.  
The new rooms of the Society are on the  
southeast corner of Broadway and Twenty-  
third street, nearly opposite Fifth Avenue

Hotel, and overlooking Madison Square; en-  
trance 4 East Twenty-third Street.

Until September 1st they will be open from  
9 o'clock A. M. to 5 o'clock P. M., except Sat-  
urdays, when they will be closed at 3 o'clock,  
P. M. All the meetings of the Society are  
henceforth to be held at 8 o'clock P. M.

Members—particularly those from out of  
town—are invited to make these rooms their  
headquarters. Appointments with other par-  
ties may be kept here; and for such, and  
similar personal matters, a private room can  
now be had.

AN INDEX TO TRANSACTIONS, VOLUME III.  
and preceding, announced to appear with  
May number, will be issued as soon as pre-  
pared.

PAPERS FOR THE NORMAN MEDAL should  
be presented before September 3d next. The  
conditions of award are set forth in the Code  
of Rules heretofore published in Transac-  
tions; or a copy will be furnished to appli-  
cants.



## LIST OF MEMBERS.

## ADDITIONS.

BAXTER, GEORGE S. [J.]	Ass't Eng. Fourth Av. Improvement, Grand Central Depot, New York.	June 1, 1875.
BLAND, JOHN C. [J.]	Care J. H. Cofrode & Co., 530 Walnut St., Philadelphia, Pa.	" " "
HARDING, GEORGE E.	52 Broadway, New York.	May 21, "
LAFON, THOMAS [J.]	Newark, N. J.	June 22, "
MENOCAL, ANICETO G.	Civil Engineer U. S. Navy, Washington, D. C.	" 8, "
PAINE, WILLIAM H.	Ass't Engineer New York & Brooklyn Bridge, Brooklyn, N. Y.	May 24, "
STUCKLE, HENRY W. [J.]	Construct'g Eng. Long Island City Water Works, 9 Livingston Place, New York.	June 8, "

## CHANGES AND CORRECTIONS.

BAYLEY, GEORGE W. R.	Res'd Eng. South Pass Jetty Works, 122 Common St., New Orleans, La.
BEEBOUT, EDWARD N.	Res'd Eng. Pennsylvania Co., Ashtabula, Ohio.
CORTHELL, E. L.	Ass't Eng. South Pass Jetty Works, New Orleans, La.
CORYELL, MARTIN	7 Tenth St., Richmond, Va.
EMERSON, GEORGE D.	Rollo, Mo.
FORD, ARTHUR L. [A.]	Newfane, N. Y.
HARRIS, CHARLES M. [A.]	P. O. Box 534, New York.
HAVEN, WILLIAM A.	92 Fulton Avenue, Rochester, N. Y.
ILLSLEY, WILLIAM A. [J.]	519 Locust St., St. Louis, Mo.
KNIGHT, WILLIAM B. [J.]	240 E. 77th St., New York.
MCALPINE, CHARLES L.	152 Broadway, New York.
MERZ, F. W. [F.]	74 Green St., Louisville, Ky.
MORRIS, MARSHALL	Jefferson Mines (Jefferson Co.), Ala.
NEWMAN, ROBERT M.	Jackson, Mich.
NORTH, EDWARD P.	Milwaukee, Wis.
RICE, EDWARD C.	2934 Pine St., St. Louis, Mo.
TUCKER, STEPHEN D.	Care R. Hoe & Co., 504 Grand St., New York.
VAN BUREN, JOHN D., JR.	18 High St., Albany, N. Y.
WRIGHT, WILLIAM W.	418 Walnut st., Philadelphia, Pa.

# AMERICAN SOCIETY OF CIVIL ENGINEERS.

## PROCEEDINGS.

### MINUTES OF MEETINGS.

(Abstract of such as may be of general interest to members.)

#### OF THE SOCIETY.

JUNE 10TH, 1875. THE FOURTH AND EVENING SESSION OF THE SEVENTH ANNUAL CONVENTION\*, was called to order at 7½ o'clock, for the transaction of regular business; Vice-President Ellis in the chair.

Reports presented May 12th were taken up:—that giving "Statistics of the Cost and Work of Pumping Engines,"† by Messrs. Gorham P. Low, Jr., W. Milnor Roberts and John Bogart, Committee, was accepted after debate and the Committee discharged; that on the "Form, Weight, Manufacture and Life of Rails,"‡ by Mr. Ashbel Welch, Chairman, and that on "Railway Signals,§" by Mr. J. Dutton Steele, Chairman, were accepted and the Committees continued.

The report on "Tests of American Iron and Steel,"\*\* by Mr. W. Sooy Smith was considered; after debate, the report was accepted and the Committee continued.

THE SECRETARY said: The Committee in concluding this report, state:—"this is, undoubtedly, the most important investigation ever undertaken by our government, in its relation to the industrial interests of the country. It had its birth in the American Society of Civil Engineers, and as its own child should be fostered and helped. Large appropriations of money will be needed from year to year, and so long as the work of the Board is carried forward in the spirit in which it was conceived, it is hoped that each member will exert his influence to secure the means required. To this end, the Committee would ask that it be continued, or a new Committee appointed, to represent the Society before the government in the matter of these tests and investigations."

MR. CROES enquired,—what is the object of the Committee?

MR. SHINN said:—The Commission appointed by the government to test iron, steel and other metals has a work to do and an appropriation to do it with. It is not at all

likely that this sum will be sufficient to meet the expenses of the work, and doubtless the process by which the original appropriation was reached and the authority for appointing the Committee was had, must be again employed to secure additional funds and a continuance of the Commission. As the matter is one of vital importance to the Society, it seems proper that the Committee already charged with it, should be retained.

MR. HOLLEY said:—I think I express the feelings and wishes of the Government Commission when I say it is hoped that the Committee will be retained, or a permanent committee appointed on this subject, as a means of communication between the Commission and the Society, rather for advice and council than for getting money. I hope that the Committee which has so far successfully prosecuted the work will be continued.

\* Proceedings of the Seventh Annual Convention continued from page 252.

† Transactions, page 142. ‡ Do. page 136. § Do. page 147. \*\* Page 222.

The reports on the "Means of averting Bridge Accidents" were considered; the resolution relating to the matter, offered by Mr. Macdonald during the preceding session, was taken up.

MR. MACDONALD said:—I will call attention to the fact, that by the first clause of the resolution, the Society adopts that portion of the reports which specify what the loading on bridges should be; the subsequent clause of the resolution refers to the question whether it is desirable to secure legislation. These two distinct objects are to be kept in mind—one to accept the standard as the work of the Society, and the other to appoint a committee to examine and report hereafter as to the advisability of legislation to get that standard before the public.

The revision referred to, in the resolution, consists in making slight changes in the rolling load per foot, upon spans above 15 feet, spans of 30—of 175—and of 200 feet, as will appear upon comparison of the tables. (Transactions, pages 124 and 132.)

The report is thus put in the simplest possible form, and the Committee having agreed upon a standard, it is for members to say whether it is proper for the Society to adopt it. Those of us who are brought in contact with parties charged with the erection of bridges feel that an important question is involved—affecting the engineer as well as the constructor. This is no new thing; standards are recognised in older countries, and officers of the government are appointed to see that these standards are adopted in practice. There is no such authority in this country, and it seems to me proper, that the American Society of Civil Engineers should take the initiative and fix upon what is to be regarded the first and essential requisites of a safe structure.

MR. C. SHALER SMITH said: I have a letter from Soulerin, James & Co., Milwaukee (of

whom, Mr. Soulerin is probably known to many here present), giving measurements of a peculiar bridge in Indianapolis, from which I will read. The bridge is 20 feet wide, with one sidewalk 7 feet wide; the span is 92 feet; depth of chord 22 inches, and of truss  $6\frac{1}{2}$  feet; section of each lower chord  $3\frac{1}{2}$  square inches; the end ties, next the abutments, are composed of two  $\frac{7}{8}$ -inch rods, cut down by a screw thread to  $\frac{5}{8}$ -inch. You can judge how safe that bridge is.

MR. READ said: A similar bridge, over a canal, went down last winter. The span was 45 feet and depth of chord 16 inches; under a load of 50 pounds to the square foot of roadway, there would be a strain of 30 000 pounds to the square inch on the lower chord. Several similar structures were within 3 or 4 miles of Indianapolis.

MR. CROES said: The resolution is divisible into two parts; one asks the adoption of a certain standard by the Society, and the other the appointment of a committee to consider whether special legislation is advisable, the report to be submitted to members for vote by letter-ballot. The question of the adoption by this Society of a standard for bridges, is one which every member should have a chance to vote upon. There is a difference of opinion among us, as to whether this association should establish a standard—not but that a standard should be fixed, and by competent authority—but if we, as a Society, take such action, would the erection of bridges such as have been spoken of, be prevented. With this view, I will offer the following, which will meet objections urged against the resolutions, and refers the discussion to the whole membership.

Mr. Croes offered this as a substitute for the resolution, and it was seconded:

Resolved; that the following be submitted to the Society, to be separately voted on by letter ballot, before September 1st next:

First; that a standard of strength of bridges be adopted by this Society.

Second; that the standard to be adopted, be the one proposed in the report of Messrs. Eads and Smith, as revised.

Third; that a committee be appointed to devise a plan for the procuring of special legislation on this standard.

MR. HERSCHEL said: Unless I am mistaken this will be the first time the Society, as a body, has expressed an opinion, and it does not seem to me right that it so do now, unless

specially called upon. That a standard of loading for bridges, taken by itself, does not really mean anything, appears by the frequent complaint of people who find that a bridge

constructed for a certain load, does not bear it. To adopt by vote such a standard of loading, seems to be a useless proceeding.

Mr. Macdonald moved that the Convention go into a committee of the whole, for the discussion of the subject, which, on vote being taken, was not acceded to.

Mr. MACDONALD said: It occurred to me, there might be a question about the legality of any resolution of this kind passed by us here; hence I moved to go into committee of the whole. It is held by many members, that business cannot be transacted at these Annual Conventions.

Mr. COOKE said: It is proposed by Mr. Macdonald's resolution to adopt a standard without a vote of the Society at large upon it. I deem it essential and important, that the members decide the question by ballot. This association ought not to establish any standard which could be fairly criticised. We should act without haste in this matter, and decide, if we decide at all, after mature deliberation. I doubt whether many members here present have examined it carefully enough to enable them to express their views and cast their votes understandingly; hence, I desire that the resolution be referred to a ballot, so as to give all of the Society who wish, the opportunity of considering it more fully.

Mr. JOSEPH P. DAVIS said: I would ask these questions—what is meant by the Society adopting a standard; what effect, such would have on a member who refuses to follow the standard; will it place him in a bad position in the Society, and what benefit is to be derived from adopting a standard? These are questions of considerable importance.

On motion of Mr. Shinn, the matter was temporarily laid on the table, for the reception of a report from the Committee on "Policy of the Society" presented by Mr. Holley, Chairman.

The Report is as follows:

The Committee appointed to report upon the matters contained in Mr. Boller's paper proposes no further changes in the By-Laws, but it respectfully suggests to this Convention, the formation of a more permanent committee, to take into mature consideration all changes in the By-Laws and Constitution.

The Committee desires to make the following suggestions, in regard to the policy which should govern such changes.

The subject which appeared to require the most immediate attention—the formation of special committees to report on engineering subjects is, perhaps, sufficiently provided for in the resolution adopted by the Convention,\* that such committee shall be formed by a

The appointment of a committee, as proposed, is another matter. The two parts of the resolution should be voted on separately.

Mr. COLLINGWOOD said: While I approve the objects of the resolution and the action of the committee, I think that now, as a Society we are hardly prepared to adopt a standard. A commission has just been appointed by the U. S. government to test iron, steel and other metals, from which valuable results are expected, bearing directly on the strength of structures. I scarcely can see how, at the present time, any number of men engaged in bridge construction can agree on a definite standard—one which will be accepted as a rule over the whole land; for our ideas as to the nature and resistances of the materials we ourselves use, are not yet settled. I believe the end had in view by this committee, will be furthered as much by the publication of its reports and these discussions, and the public attention caused thereby, as by the proposed adoption of a standard by the Society. Suppose a standard is now adopted, what certainty is there that the desired result will be reached and how soon will it be necessary because of new data to make a change. I think the committee should be continued and put in communication with the Board on tests of iron, steel, etc., and in time their joint action will prepare the way for the adoption of a permanent and authoritative standard for the strength of bridges.

majority of the votes of the Society, either in Convention or Annual Meeting, or by letter ballot. The Committee purposely avoided recommending that any limitations be imposed on such special committees, believing that the proposed method of appointing them, and the lately awakened attention of members to the importance of limiting themselves in these matters, will, for the present at least, fully meet all the requirements. It also seems impracticable to make general limitations to cover special cases.

While admitting the importance of revision of the laws governing the Society, and of some additions to them, the Committee cannot refrain from expressing a belief, that the danger in associations like this, as well as civil affairs, is that there be too much government and too many laws, rather than the

\* Page 250.

contrary. It is undoubtedly better to postpone legislation until evils become so imminent as to unmistakably threaten danger, than to attempt to provide for contingencies which do not yet exist.

The resolution proposed by Mr. Shinn, and referred to this Committee, is recommended for adoption by this Convention.\*

The Committee recommend that the Library Committee consider the abandonment of the copyright system.

The Committee is of the opinion that social meetings similar to the *Conversations* of the Institution of Civil Engineers, would contribute to the interests of the Society, but recommend that for the present, such meetings be arranged and conducted at the expense of those members who are willing to inaugurate the system.

It is farther suggested, that whenever new or doubtful questions arise affecting the policy of the Society, the Board of Direction shall—by circular and reply, in manner similar to the letter-ballot—refer the same to the membership for an expression of opinion.

By an unwritten law of the Society, the officers have heretofore been selected from the

\* Page 251.

On motions of Messrs Cooke and Herschel, the report was adopted and referred to the Committee—which was continued for the purpose—to bring before the Society at the next regular meeting, in such shape as may appear most advisable.

Consideration of reports on the “Means of averting Bridge Accidents” was resumed.

Mr. HERSCHEL said: It is now proposed that, in the event of the adoption of a standard, to refer it to a committee of three, which shall report as early as possible, upon the advisability of securing legislation in the premises. I think that legislation should be irrespective of standard, and refer only to the testing of bridges.

Mr. Macdonald accepted the substitute for his resolution, offered by Mr. Croes.

Mr. Herschel offered the following amendment, which was adopted:

Resolved; that the Committee on the “Means of averting Bridge Accidents” be continued, with instructions to report to this Society, at as early a day as practicable,—for the purpose of being voted on by letter-ballot—the draft of a law to be recommended to the several State legislatures, which law shall be designed to effect the more perfect prevention of bridge accidents.

Mr. SEARLES said: The first clause of the substituted resolution is, that a standard of strength of bridges be adopted; how can this be done, until it is known what such standard is to be.

resident class; it is suggested that so long as enough members of the Board of Direction, to transact business, reside near New York, other officers may be chosen as representative men without reference to their location.

Mr. COLLINGWOOD said: I would enquire why the proposed changes were placed in the By-Laws and not in the Constitution; the former can be modified or repealed at any regular meeting by the members there present, due notice having been given at a previous regular meeting. If it is desirable that these Conventions be considered as business sessions, such should be expressed in the Constitution.

Mr. SHINN said: I hope that this report will be adopted and referred to a committee to present at the next regular meeting of the Society. It expresses what we all want to arrive at and proposes a settlement of questions which have crept into this organization, particularly that of the right of a Convention to transact business.

I differ with Mr. Collingwood on the point he makes. I have examined the Constitution and By-Laws in reference to this subject, and so has the Committee, and I am fully satisfied this provision should be put in the former.

Mr. CROES said: We should strike at the root of the matter, and put the main question first—whether a standard shall be adopted at all—then the question may come, is the standard now proposed, the best. Mr. Macdonald’s resolution comprises the two; many members might be in favor of adopting a standard, and yet be opposed to this one.

Mr. COLLINGWOOD said: If we vote aye on the resolution, we decide that it is desirable now to adopt a standard, and thereby virtually render void previous action of the Society—the appointment of a government commission

to determine the very elements upon which a standard is to be based. In view of the fact that within a short time we shall have much more definite knowledge, it is not expedient now to appoint this committee. I concede the necessity of establishing a standard, and, if the resolution merely affirmed that, or that it is desirable the Society should, at some future time, adopt a standard, I would

support it. I favor Mr. Herschel's resolution, because it proposes legislation which shall prescribe, that tests be made on bridges of certain lengths and widths without reference to materials or strains.

The fact that the members of the Committee are not agreed in their reports shows that we, as a Convention and a Society, cannot now adopt a standard.

Mr. Croes resolution as amended, was submitted to vote, and not adopted.

Mr. Herschel offered the following, which was amended by Mr. Croes:

Resolved; that the members of this Society be called upon to vote by letter-ballot, to be opened September 1st next, on this question; shall the Committee on the "Means of averting Bridge Accidents" be continued, with instructions to report to the Society—for the purpose of being voted on by letter-ballot—the draft of a law to be recommended to the several State legislatures, designed to effect the more perfect prevention of bridge accidents.

MR. MACDONALD said: The report which has just been set aside, is the fruit of the labors of a committee, the members of which—widely scattered over the United States—have worked upon it two years and given much careful thought to it, and now their action has been entirely thrown over. Great disappointment will follow: of course no association is bound to accept any report its committee makes; but now there is a resolution before us retaining this Committee on the "Means of averting Bridge Accidents," and instructing it to attempt much more difficult work than has been rejected. We of the Committee thought when we began, it was simple enough to propose a standard which would be satisfactory to engineers, but after disparaging our ability in that respect, you now ask us to get up a standard to be approved by the legislatures of the several States; the absurdity is apparent.

MR. HERSHEY said: I do not think the report of the Committee has been set aside. It was treated with great respect and is much esteemed, but for us as a body, to adopt the

standard proposed, or any other, when we as a Society, have not said that any standard should be adopted, is quite another thing.

What has been here said on this question will indicate to the Committee the different views of members. Although, as stated, it is difficult for the Committee to meet and confer, I think that a report, and a valuable one, may be soon made, perhaps at the next Convention. There is, however, no need of haste, the Commission to test iron and steel, doubtless, will establish important data, and if the subject should for the next three years be discussed in the Society, I do not think the time will be wasted.

MR. CROES said: I favor Mr. Herschel's resolution, for the reason that it puts the matter before the Society. I opposed the other, because it seemed to be premature—and this, I think, is the opinion of most of those who voted with me.

MR. WRIGHT said: Because I thought the proposed action is premature, at this time, I voted against Mr. Macdonald's resolution.

A vote was taken, and the resolution of Mr. Herschel was not adopted.

On motion of Mr. Cooke, the Committee on "Means of averting Bridge Accidents" was continued, with instructions to report from time to time, upon the matter submitted to it.

A communication from Mr. Charles K. Graham, dated May 29th, was read and ordered on file.

MR. GRAHAM wrote: \* \* \* I would respectfully suggest the appointment of a committee of six members of the Society—three of them United States engineers, and three of them civil engineers in the active practice of their profession—for the purpose of making

a thorough examination of the plans now in use in this Department,\* with the view of determining whether the system of *beton*

\* The Department of Docks, New York, of which he was at that time, the Engineer-in-Chief.



*en-masse* is one which can be safely and economically adopted in future works.

It is likewise highly important that the manufacture of hydraulic cement should be encouraged in this country, so that the home manufacture may be eventually substituted for the imported article, and I would also suggest that this same committee be charged with the duty of testing all the cements,

whether native or foreign, which are now offered in this market.

It gratifies me to state, from recent tests made by my assistants in this Department that certain American hydraulic cements are rapidly approaching the tensile strength of the English Portland, and I hope at no distant day, they may entirely supercede those brought from the other side of the Atlantic.

Topic V. "Plan for the Benefit of Families of deceased Members" was taken up—the resolution offered by Mr. William E. Worthen, April 7th, was considered.

THE SECRETARY said: At a regular meeting of the Society, April 7th, the following was made an order of business at this Convention:

"Resolved, that a committee be appointed to investigate the possibility and propriety of organizing the Society—as a whole or by voluntary membership—as a Mutual Benefit Society, to aid and benefit the families of deceased members." In the absence of the mover of the resolution, I will endeavor to outline his views relative to such an organization, by referring to the rules of a society similar to the one proposed, now in successful operation.

The object is to form within the Society an association to aid and benefit the families of those who belong to it; on becoming a member

of the organization and after the death of a member, each person to pay a prescribed fee, the fees to be deposited in a savings bank; and when a member dies, the amount of such deposit together with the accrued interest, less necessary expenses up to that time, to be paid to his family or other beneficiary, as designated by him.

It will be noticed that this may be the result of a voluntary effort on the part of those only who desire to unite for the purpose, and not otherwise be in any sense a Society affair.

Mr. Croes said: The resolution commits the Society to nothing. It merely asks the appointment of a committee to examine into the subject and report to the Society for such action as may then seem best.

The resolution was adopted. On motion, the resolutions offered by Mr. Croes, April 7th, relating to nomenclature in masonry, and to the guaging of streams,\* were made an order of business at the next regular meeting of the Society.

The Convention adjourned.

JUNE 16TH, 1875.—A stated meeting was held at 8 o'clock, P.M.

A paper on "Levees," by G. W. R. Bayley, C. E., of New Orleans, was taken up: the proceedings of the Seventh Annual Convention were considered and a discussion followed, whether members attending such meetings should accept for the purpose, transportation over railway lines.

The formal session closed at 9 o'clock, after which an hour was given to conversation.

JULY 7TH, 1875.—A regular meeting was held at 8 o'clock, P.M.

The votes on admission to membership were canvassed, and the following declared elected: Members—Messrs. D. Farrand Henry, C. E., of Detroit, Mich.; Isaac Morley, C. E., of Pittsburgh, Pa. and Joseph S. Sewall, C. E. of St. Paul, Minn.; and Juniors—Messrs. Augustus J. Du Bois, C. E., of New Haven Conn.; William N. Radenhurst, C. E., of New York and William B. Ross, C. E., of Nashville, Tenn.

\* Page 210.

A communication from Mr. James B. Eads in reply to the discussion of Mr. Samuel H. Sheve, on "Upright Arched Bridges," in May Transactions was read.

A motion that the rooms of the Society be open every week-day evening was referred to the Committee on Library, with power; and one, that a committee be appointed to report upon the merits of the "Keely Motor," without expense to the Society and in conformity to its By-Laws and rules, was not acceded to.

The Committee on "Policy of the Society," not being prepared to report, it was moved that the report of this committee be printed in "Transactions," and made an order of business at the regular meeting of the Society, September 1st.

Consideration of the resolutions offered by Mr. Croes, April 7th, was laid over, to be taken up also at that meeting.

#### OF THE BOARD OF DIRECTION.

JUNE 2D, 1875.—A stated meeting was held at 4 o'clock P.M.

Proposals for admission to the Society were considered, appropriations for the third quarter of the Society year made, and other routine business transacted.

JULY 7TH, 1875.—A stated meeting was held at 4 o'clock P.M.

Proposals for admission to the Society were considered, and other routine business transacted.

#### NEW BOOKS ON

### ENGINEERING AND TECHNOLOGY.

Under this head will be announced new books on these and kindred subjects published in English, French and German, which may be professionally useful to members of the Society. The original titles of foreign books noted here will be furnished, on request.

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Architecture, Elements of—with Drawings from classic Monuments and Authors. P. G. Marie. Paris, (French.) 8vo, text; folio plates. 12f.

—; History of—in all Countries, from the earliest Times to the present Day. James Ferguson. New and rev. ed. 4 Vol. Vols. I, II. Ancient Architecture; Vol. III, Indian Architecture (in preparation); Vol. IV, Modern Architecture. London. 8vo. (Scribner, Welford & Armstrong, New York.) per vol. \$12.

—; Manual of—for Churches, Parsonages, and School Houses: containing Designs Elevations, Plans, Specifications, Forms of Contract, Rules for estimating Cost of Building, with Suggestions on Acoustics,

Ventilation, Heating, Lighting, Painting, etc., for the Southern and Western States. New York. 4to. Bicknell. \$5.00.

Assyrian Discoveries; an Account of Explorations and Discoveries on the Site of Ninevah in 1873-4. George Smith. 4th ed. London. 8vo, illus. Sampson, Low, Marston & Co. 18s.

Beam; Notes on the Calculation of Strains, developed in a Beam curved in a circular Arc, with a Study on the Change of Form of a prismatic Body subjected to any external Forces. Alfred Gonilly. Paris (French). 8vo, illus. 3f.

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- Bridge Engineers, Hand-book for — — — Clemens Herschel. 3 Vols. Cont.,—1: Straight and Beam Bridges;—2, Suspension and Arched Bridges;—3, Stone Bridges, Bridge Piers, and their Foundations. New York. *John Wiley & Sons*. (Announcement.)
- Bridges; Treatise on the Construction of— M. Morandiere. Part II. Paris (French). 4to. text; illus., folio plates.
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propriation for—.

Rivers and Harbors ; Examination and  
Surveys of certain Rock, Castle and Big  
Sandy Rivers, Kentucky and Nassau  
River, Florida ; Examinations and Surveys  
of Sabine Pass, Texas ; Improvement of  
Saint Croix and Chippewa Rivers ; Ex-  
aminations of—.

— Examinations of—.

Wolf Lake Cut, Indiana ;—Sebawaing River,  
Mich. ; Mouth of Saginaw River, Mich. ;  
Grand Marais Harbor, Lake Superior,  
Minn. ;—Dakota River, Dakota Ter. ;—the  
Estuary in Santa Barbara Channel, near  
Point Muger, Cal. ;—Sacramento River,  
below Tehama, and Feather River, below  
Marysville, Cal. Surveys and examina-  
tions of—.

Saint Clair & Carondelet Bridge.

Saint Joseph Harbor, Mich. Amount re-  
quired for its Improvement.

San Joaquin River, Cal., and Yamhill  
River, Oregon ; Examination and Survey  
of—.

San Jacinto River ; Examinations of Ob-  
structions to the Navigation of—.

Torpedo Trials ; Appropriation for—.

Withlacoochee, Oconee, Ocklocknee, Hia-  
wassee, Cahawba and Black Warrior

From G. W. Pearsons, Kansas City,  
Mo. :

Report of the Chief Engineer and Committee  
of Construction of the Water Works at  
Kansas City, Mo., to April 15th, 1875.  
Copies for distribution.

From Ernest Pontzen, Vienna:  
Management of the Danube at Vienna.  
Vienna. 1875. (German.)

Proceedings of General Convention for the  
"Improvement of German River and Canal  
Navigation" on January 30th, 1875, at Ber-  
lin. Berlin. 1875. (German.)

Special Committee to the Centennial Exposi-  
tion at Philadelphia in 1876—Circular of  
the Austrian Society of Engineers and  
Architects to its Members. (German.)

From H. V. & H. W. Pocr, New York :  
Manual of the Railroads of the United States,  
1875-6. New York.

From the Railroad Association of Amer-  
ica, St. Louis, Mo. :

Journal of the Association, May, 1875. St.  
Louis.

From E. C. Rice, St. Louis, Mo. :

Profiles of the St. Louis, Vandalia & Terre  
Haute—the St. Louis & Southeastern—the  
Tennessee & Kentucky division of the latter  
—and of the Cairo & Vincennes R. Rs. (4  
 tracings.)

From David A. Stewart, Pittsburgh,  
Pa. :

Columbia Oil Co's Record of Wells, July 1st,  
1873.

From Robert H. Thurston, Hoboken,  
N. J. :

Memoirs and professional Reports.

From William H. Twiss, Cortland,  
N. Y. :

Drawings of Wrought Iron Bridges. King  
Iron Bridge & Manuf'g Co.

From Lieut. George M. Wheeler,  
Corps of Engineers, U. S. A. Wash-  
ington, D. C. :



Geographical Explorations and Surveys West of the 100th Meridian. Systematic Catalogue of Vertebrata of the Eocene of New Mexico, collected in 1874. E. D. Cope, Paleontologist. Washington, 1875. (2 copies.)

From Joseph M. Wilson, Philadelphia. New Pavilion Ward of the Presbyterian Hospital of Philadelphia. Philadelphia. 1875. (2 copies.)

Specifications for Passenger Depot, Baltimore & Potomac R.R. at Washington, D. C. Philadelphia. 1873. (2 copies.)

for Superstructure of Bridge over the Pennsylvania R. R. at Ellsworth Avenue, Pittsburgh, Pa. (8 copies.)

From Miscellaneous Sources:

Dead Heads, or who ride free on Railroads? C. U. Felt. Boston, 1874.

Fishkill Process for manufacturing Peat Fuel. New York, 1870.

Specifications and Drawings of Patents issued from the U. S. Patent Office for October and November, 1874. Washington, 1875. 2 volumes.

## ANNOUNCEMENTS.

**MEETINGS:** The next stated meeting of the Board of Direction will be held August 4th, at 4 o'clock P. M., for the transaction of regular business.

The next regular meeting of the Society will be held Wednesday, September 1st., at 8 o'clock P. M., when ballots for members will be canvassed, the report of the Committee appointed at the Seventh Annual Convention on the "Policy of the Society" presented, and the resolutions of Mr. Croes offered April 7th, relating to nomenclature in masonry and to the gauging of streams\* considered. The formal session will close at 9 o'clock, after which an hour will be given to conversation and social enjoyment.

No regular or stated meetings of the Society will be held from July 7th to September 1st.

The new rooms of the Society are on the southeast corner of Broadway and Twenty-third street, nearly opposite Fifth Avenue Hotel, and overlooking Madison Square; entrance 4 East Twenty-third Street. Until September 1st they will be open from 9 o'clock A. M. to 5 o'clock P. M., except Saturdays, when they will be closed at 3 o'clock P. M. All the meetings of the Society are henceforth to be held at 8 o'clock P. M.

Members—particularly those from out of town—are invited to make these rooms their headquarters. Appointments with other parties may be kept here; and for such, and similar personal matters, a private room can now be had.

**TESTS OF IRON AND STEEL.**—This order relates to the U. S. Board on Tests of Iron and Steel.

WAR DEPARTMENT,† }  
Washington, June 23d, 1875. }

By direction of the President of the United States, in compliance with the request of the

Board for Testing Iron, Steel, etc., and with the concurrence of the Chief of Ordnance, the executive order of March 25th, 1875,† appointing the said Board \* \* \* is hereby amended by striking out the words "the Chief of Ordnance," and substituting therefor the words "the President of the United States."

The following from circulars issued by the Board, it is presumed will be of interest to members.

I. The Commission appointed by the President of the United States to experiment and report upon the metals used in construction, desires to secure the assistance of all who are interested in this great work, and through them to obtain all information available as the result of the labors of earlier, or of contemporaneous, investigators and observers.

I take the liberty of enclosing herewith circulars indicating the scope of the labors undertaken by this Commission, and beg that you will aid, by such methods as may be by you deemed best, in the collection of all information which may be accessible, relating to either the general work of the Commission or to the special subjects assigned to its committees.

Data collected in the course of ordinary business practice, and the records of special researches previously made or now in progress, are particularly desired.

It is expected that the Commission will receive valuable information and useful suggestions, both from business men and from men of science, and it is hoped that the work undertaken as here indicated may be supplemented by original investigations made by both these classes.

The national importance of this work justifies the expectation of an earnest and effective co-operation.

R. H. THURSTON, Secretary.

\* Page 210. † Gen. Order No. 66. ‡ Page 219.

II. In reply to your favor, I am directed to say that the U. S. Board appointed to test Iron, Steel, etc., will be prepared to receive specimens for test immediately upon the completion of the testing apparatus and machinery now ordered.

Notice will be given at the proper time, by circular and through the public press, of the completion of all preparations.

Instructions will be given, at the same time, in regard to the form and dimensions of specimens and the nature and extent of the information which will be expected to be furnished with them.

By order of the Board,

R. H. THURSTON, Secretary.

III. The United States Board to Test Iron, Steel, etc., appointed by the President of the United States, in accordance with Section 4 of the Act of Congress, making appropriations for sundry civil expenses of the Government, and approved March 3, 1875, has assumed, as a part of its work, the investigation of the methods and effects of abrasion and wear of metals in engineering and mechanical operations.

This committee is instructed to take up this subject and to report such valuable data and statistics, and such information as it may acquire by experiment or from other observers, in such form that it may be readily collated and made useful to the Government, the public, and the engineering profession.

The committee would be pleased to receive from any reliable source such precise data and such information as may enable the Secretary to compile, in as concise and exact form as possible, a statement of the mode of deformation, the rapidity of abrasion and the laws governing wear in any important typical or exceptional cases.

The executive officers of all lines of railway may render valuable aid by furnishing statements of the wear of rails per ton of transportation, specifying with care the original weight, the make, and the character of the rail, the total amount of transportation, the length of time occupied, and stating whether the rail finally broke or was removed. Specimens of rails remarkable either for endurance or for a lack of this quality, if sent to the committee, will be of use in assisting in the determination of the chemical and other properties which most affect the value of the material under the stated conditions of use.

Similar statistics and information in regard to the wear of wheels, axles and other parts of rolling stock and machinery, will be equally valuable. Engineers having in any instance noted and accurately recorded such data, are

requested to transmit to this committee copies of their memoranda.

The wear of journals under heavy loads, or at high velocities, as well as under ordinary conditions, is an important branch of this subject. When possible it is desired that the dimensions of the journal, the maximum, the minimum and the mean weight sustained, and the velocity of rubbing or number of revolutions per minute should be given. The nature of the lubricant is an essential element and its composition should be stated, the method and frequency of application and the quantity used should be given. When known, or readily ascertained, the coefficient of friction should be given. It should also be noted whether heating occurs, and under what circumstances of pressure and velocity of rubbing surfaces.

Peculiar instances of the behavior, or unusual expedients in the management of, bearings, if described accurately and concisely, will be accepted, with thanks.

The wear of tools, under the various conditions of workshop practice, is another subject of investigation. Weighing the tools carefully before and after use, and weighing the amount of metal removed will, perhaps, be found the most accurate method of determining the rate of abrasion. The area of surface finished, and the area of the surface cut by the tool should be accurately ascertained and stated.

The description of the tool, its shape, method of operation, the kind of metal used in the tool, the temper adopted, the character of the metal cut by it, the velocity of the tool, and where peculiarities of behavior were noted, a careful statement of them—should be given. This information will still be more valuable if the tool itself and specimens of the chips produced by it are furnished. The power required to drive the tool can sometimes be readily determined, and such information is of great value.

The recent investigations of M. Tresca—*Memoir Sur le Robotage des Metaux*, etc.—is an excellent example of such research.

For all information which may properly fall within the limits of their investigation, this committee will return suitable acknowledgments.

R. H. THURSTON, Chm. Com.  
on Abrasion and Wear.

IV. The U. S. Commission on the Tests of Iron, Steel and other metals, proposes making a series of determinations of the effects of carbon, phosphorus, silicon, manganese and other elements, upon the strength, toughness,

elasticity and other qualities of iron and steel. The specimens will be analyzed by the chemists attached to the Commission and subjected to tension, torsion, compression and other mechanical tests. All experiments will be repeated often enough to reduce errors to their minima.

You would greatly aid the Commission, as well as the iron trade, by furnishing iron and steel bars, as follows (*to be 7 feet long and 1½ inches round*): Bars to be rolled, in case you have suitable rolls; if not, hammered billets, 3 in. square by 18 in. long, to be furnished in place of bars. Bars to be stamped on one end with the initials of the maker, and the number of the heat or charge at which they were made; or, in case there is no such record, to be stamped with the initials of the maker and numbered on one end.

A full description of the kind and make of raw materials, and of processes employed in the manufacture of the bars, and also of the size of the ingot or pile, the number of reheats, and the extent to which hammering or rolling were employed in the reduction, to be kept in a reference book—each description having a number corresponding with that of the bar—would be of great value. Such a record is, therefore, particularly requested.

Your own analyses, including color carbon tests—in case you have made them—to be given in the above description. Your mechanical tests of the material furnished, with statement of shape and dimensions of specimens tested; to be also recorded and furnished. (*Please store the bars until the Commission informs you where to send them.*)

Of steel there is wanted—one bar each, containing 0.1, 0.2, 0.3, 0.4, 0.5, 0.6, 0.7, 0.8, 0.9 and 1 per cent. of carbon. After selecting these bars by means of your carbon tests, please repeat the tests, so that there may be no error. It is very important that the other elements should be uniform; therefore, these bars should be selected from charges made as far as possible from the same raw materials, and under similar conditions.

Also one bar each of such irons or steels as may show any particularly good or particularly bad qualities, or such as may exhibit any very marked or unusual characteristics. One of your best wrought iron, with its trademark stamped on; one of very hard, but not cold short wrought iron; one of extremely soft wrought iron, and one of average "puddled steel." Any bars which you think may be usefully subjected to these tests—specially describing the materials and processes employed in making them, and their characteristics.

When these bars are tested, it is proposed to test a series in which the manganese varies by tenths of a percent., other elements remaining the same, and another series for phosphorus, and so on.

Tool steels will be tested in another series of experiments.

These determinations must, of course, require thousands of specimens, and be continued through a series of years. The final result must inevitably lead to a scientific synthesis in the iron and steel manufacture, by which all required mechanical qualities can be accurately produced at pleasure.

A. L. HOLLEY, Chm. Com's Chemical Research and Steels by modern Processes.

V. The Board appointed \* \* \* "to test iron, steel and other metals," has instructed this Committee to continue an investigation of those modifications of the various properties of the metals which are produced by changes of temperature.

The committee is desirous of supplementing these experimental researches with such results of other experimental work and of observation as may be obtainable from authentic sources; it, therefore, solicits such contributions from investigators and observers as may be deemed valuable as assisting in the task assigned.

The behavior of rails and of machinery exposed to the extremes of temperature observed in northern latitudes, where exposed to wear or to breakage, will be likely to afford valuable data. The character of the fracture and the texture of the abraded surfaces, as well as the statistics ordinarily collected, should be noted. Specimens exhibiting peculiarities of behavior or appearance, and photographs of masses which it may not be convenient to forward, will be of value. Where exact quantitative analysis of metals exhibiting unusual characteristics can be given, they will and effectively in the determination of the causes of such peculiarities.

The statistics of well managed railroads are expected to afford useful and reliable information. Rolling mills producing rails and other forms of rolled iron which are tested by the drop may be able to furnish more accurate statements of the effect of changes of temperature in modifying resistance to shocks.

Some experimental work has already been done in this field, and it is desired that the results of such researches may be communicated in as great detail and with as much accuracy as possible. Published monographs, reference to papers published in scientific,

engineering or other periodicals, and unpublished papers, will be received as valuable contributions.

All assistance rendered the committee in the endeavor to ascertain the character of the change of the force of cohesion produced in the metals and their alloys by variation of temperature, to determine the mathematical expression of that law, and to obtain such formulas, either exact or approximate, as will make these results conveniently and practically available to engineers and constructors, will be properly acknowledged.

R. H. THURSTON, Chm. Com.  
on Effects of Temperature.

V. A committee of the Board \* \* \* has been instructed, during such time as may be found available pending the construction of the apparatus ordered by the Board for use in general work, and during such intervals as may subsequently be properly appropriated to such purpose, to investigate the mechanical, physical and chemical properties of the alloys of the useful metals, and to determine, if possible, their interdependence and the laws governing the phenomena of combination and of their resistance to stress.

The committee desire to obtain records of all experiments which have hitherto been made in this direction, and to secure such exact information as may assist further researches. It is desirable that such records should embody a statement of the precise chemical constitution of each alloy examined, as obtained both by synthesis and subsequent analysis. Its specific gravity, specific heat, conductivity, its combining number, and the relation of its chemical constitution to the series of similar compounds produced by alloying the elements in the proportions of chemical equivalents, should be stated whenever possible. A few thoroughly well studied examples will be of more service than a large number of isolated determinations of single facts.

It is further desired that the ultimate strength, the elastic limit, the modulus of elasticity, the ductility, resilience, homogeneity, hardness and other mechanical properties of the specimen be ascertained and accurately stated.

Where only a part of this work can be done by the investigator, this committee is prepared to assume charge of the remaining portion of the research, when the alloy can be furnished in proper quantity and form.

References to published accounts of similar works and monographs on any branch of the

subject will be thankfully accepted. Special researches made for this committee will be received with appropriate acknowledgments.

The Department of Physics and of Chemistry in the various colleges and universities will probably be able to render valuable aid, and their co-operation is earnestly requested.

The Schools of Engineering are in a position to assist this committee very effectively and their contributions will be thankfully accepted.

Suitable blanks upon which to record the data offered, will be furnished upon application.

Specimens of alloys for test by the committee must be accompanied by a statement upon these blanks of their precise constitution, and such information as it is possible to give, with an account of such peculiarities as are known to distinguish the alloy, and of the special object which it is supposed may be attained by the investigation.

Where possible, it is required that one or more specimens shall be furnished of each of the specified kinds, and of precisely the form and dimensions, which will be given on application.

R. H. THURSTON, Chm. of Com.  
on Metallic Alloys.

VI. At a meeting of the U. S. Board, appointed to test Iron, Steel and other metals, held at Watertown Arsenal, June 2d, 1875, the following preamble and resolutions were adopted:

Whereas, this Board proposes, as soon as practicable, to give metal makers the benefit of its testing machines, and of a skilled experimenter at a reasonable charge, as a means by which they may give publicity to the behavior of their metals under test; it is

Resolved, that this Board decline to publish the names of metal makers in connection with the experiments certified to by the Board.

Resolved, that this resolution is not to be construed as a refusal to acknowledge contributions of metals and other aid from makers; on the contrary, such services will be always gratefully and publicly acknowledged.

Published by order of the Board.

R. H. THURSTON, Secretary.

PAPERS FOR THE NORMAN MEDAL should be presented before September 3d next. The conditions of award are set forth in the Code of Rules heretofore published in Transactions; a copy will be furnished to applicants.

## LIST OF MEMBERS

## ADDITIONS.

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DU BOIS, AUGUSTUS J. [J.]	Sheffield Scientific School, New Haven, Conn.	July 17, 1875-
FORSYTH, ROBERT	Supt. Bessemer Steel Works, Chicago, Ill.	June 30, "
HENRY, D. FARRAND	Chief Engineer Detroit Water Works, Detroit, Mich.	July 17, "
KIMBALL, GEORGE A. [J.]	Somerville, Mass.	" 7, "
ROSS, WILLIAM B. [J.]	Nashville, Tenn.	" 28, "

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## CHANGES AND CORRECTIONS.

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ANDERSON, ADNA	Receiver, C. D. & V. RR., 77 Clark St., Chicago, Ill.
BISSELL, H.	Box 2483, Cincinnati, O.
BLATCHFORD, E. W.	375 North La Salle St., [Chicago, Ill.
BOLLER, ALFRED P.	71 Broadway, New York.
BUCK, LEFFERT L.	Care E. C. Du Bois, 137 <sup>1</sup> / <sub>2</sub> Calle de la Coca, Lima, Peru.
CONSTABLE, CASIMIR	Rockwood, Tenn.
COOPER, THEODORE	Delaware Bridge Works, Phillipsburgh, N. J.
EARNSHAW, HENRY	Corner Fourth and Race Sts., Cincinnati, O.
HOUSTON, JOHN	Box 252, Jersey City, N. J.
KATTE, WALTER	City Engineer of St. Louis, St. Louis, Mo.
MERRILL, WILLIAM F.	Care T. P. & W. R'y, Peoria, Ill.
NEWELL, JOHN	Gen. Man. L. S. & M. S. R.R., Cleveland, O.
SPAULDING, IRA	29 West 17th St., New York.
TUCKER, STEPHEN D.	Care R. Hoe & Co., 504 Grand St., New York.

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## DECEASED.

GARDNER, HENRY A.	Late of Detroit, Mich.	July 26, 1875-
PRATT, T. WILLIS [F.]	" Boston, Mass.	" 17, "

# AMERICAN SOCIETY OF CIVIL ENGINEERS.

## PROCEEDINGS.

### MINUTES OF MEETINGS.

#### OF THE BOARD OF DIRECTION.

AUGUST 4TH, 1874.—In absence of a quorum, no stated meeting was held.

#### THE DINNER

##### OF THE SEVENTH ANNUAL CONVENTION

Of the Society, was had at the Monongahela House, Pittsburgh, on the evening of Wednesday, June 9th, 1875.

Gen. Theodore G. Ellis, Vice-President, was in the chair; a large number of members and invited guests were present. After the cloth was removed:

MR. JOSEPH D. WEEKS responded to the toast: The Industries and Trades of Pittsburgh.

He said:—It seems something like a work of supererogation for me to respond to this toast; in his address at the opening of the Convention, your Vice-President, Col. Roberts, fully referred to these sources of wealth and prosperity of Pittsburgh, and to-day in the tour about the city, you have seen with your own eyes a more perfect exposition of the variety, extent and completeness of our industry and trade than can possibly be made in speech.

This smoky city has a reputation throughout the land for something besides smoke. Before me is a representation of the St. Louis bridge, a structure born of the energy and genius of a member of this Society, which our mechanics helped to put into form and place. Thought is thus here expressed in deeds—in steel, iron and glass, and the many industries which gather about these products.

Something may properly be said of the magnitude of the interests thus involved; our daily product of merchant iron is between 1 200 and 1 500 tons; we have 11 blast furnaces, including some excellent in size and

quantity of product any others in the world: here about 60 per cent. of all the steel made in the country is manufactured—and which in American markets is fast superseding the foreign product. About 60 per cent. of all the window glass is also made here, and some forms of our pressed glass are superior to anything produced in Europe. It may be of interest to know that pressed glass ware is exported from this city to Germany, and from thence sent to South American markets—need I say that this trade should be direct. Large pieces of glass ware, as bowls, fruit dishes, and the like, are made nowhere else in the United States. Here they are made by blowing—in other places, the glass is pressed while hot.

The magnitude of the coal trade of Pittsburgh is well known, and by the efforts of civil engineers greatly, this trade has been diffused over the broad land. But however much we are indebted to the profession for aid in the past, we still need assistance for the future. In the planning and construction of our works—oftentimes conceived in necessity and erected in haste—there has not been shown that skill and knowledge of the fitness of things, which renders care and economy possible to the greatest extent.

To-day, a most important question connected with the future development of this city, is the improvement of the Ohio. One member of this Society, years ago made professional examination of it, and it is now again brought into prominence by the efforts



of another member to open the Mississippi to the shipping of the world—which now, in a great measure, is shut out from it and its tributaries. You, civil engineers, are expected to remove from our rivers that which restrains our commerce, so it may float without let or hindrance to the sea, and thence sail to far off ports, and with your aid, the time need not be far distant when during a large portion of the year, Pittsburgh will have unrestricted water communication with all parts of the world.

In closing, I will but express the great interest we have in the tests of iron and steel by the U. S. Government Commission, recently proposed; confident as we are that when tried fairly and completely, side by side with iron and steel from any other quarter, the products of Pittsburgh will in no degree be found wanting.

MR. WILLIAM P. SHINN responded to the toast: "The Railroad Interests of Pittsburgh."

He said:—Twenty-five years ago I came to Pittsburgh from Philadelphia and entered on the duties of a constructing engineer upon the first railroad that was built out of this city. In the spring of the following year, the first locomotive ran out of Pittsburgh on the Ohio & Pennsylvania R. R. At that time the Ohio river furnished what was supposed to be transportation *par excellence*—the noble Ohio—on which a steamboat left once a day for Cincinnati, reaching there in from 24 to 36 hours. It was not then supposed that railroads could interfere with river transportation, but within five years the Cincinnati packet was a thing of the past. To-day Pittsburgh is one terminus of railroads which extend in various directions in one continuous line over 3 000 miles. To them largely, Pittsburgh owes its present position, and in return it has furnished them with traffic second to that of no other city in the United States.

Cheap transportation, which is being made a practical question by railway companies themselves, is one, affecting the interests of the manufacturer, in which the people of Pittsburgh share second to no other. I believe this question, which some of our engineering friends have thought would be settled by canals, will instead, be solved by the railroad; that railway managers will be able to show how the products of our mines, mills and furnaces may be transported thereby to a market, at a rate of freight which will make it unnecessary to look to other improvements. This Society has contributed in no small degree to bring about that result. The discus-

sion of cheap transportation by its members, and in its Transactions, has aided in a recognition by railway companies of the facts set forth, which showed a possible economy of transportation heretofore ignored, and one of the results will be, that the manufacturing and railway interests of Pittsburgh will henceforth be more nearly identical.

MR. J. DUTTON STEELE responded to the toast: "The American Society of Civil Engineers."

He said:—The noise of the steam hammer, universal rolls, the converters and the other busy agents of Pittsburgh industry seen at work to-day, will drown the voice of a speaker, called upon as I am now, to respond for those who merely devise and construct. But I am a Pennsylvanian, and therefore most happy to meet my brother engineers in this western emporium of our State, the Birmingham of America—a title, which I hope, our good friends who have entertained us so well to-day, will be able long to preserve.

We are on historic ground. One hundred and seventeen years ago, Braddock attempted to reach, what then was Pittsburgh, situated at the junction of the Alleghany and Monongahela rivers—a little block house manned by a few French trappers or traders in furs, and supported by a very considerable band of Indians—where to-day the magnificent steel works we visited are in course of construction. With him, was a young and brave Virginian soldier, Col. Washington, who, knowing much of aboriginal life in America, went to Gen. Braddock and modestly cautioned him against entering the dense forests between Turtle Creek—the point of crossing—and Pittsburgh, without previously reconnoitering the ground. The reply, as you all know, was, "Sir, I didn't come to this country to be commanded by a Buckskin." It was not long before that brave young officer had to cover the remnant of the army left from the ambushade of Indians—on the very spot where we were to-day.

Fifty years ago, Fulton and his partners built and landed here the first steamboat—the Buffalo—ever floated on western waters. There are men still living—some probably in Pittsburgh—who made the first voyage down the river on this boat. This is nearly the fiftieth anniversary of the introduction of steam navigation in the West, as well as the twenty-fifth anniversary of the use of railroads on this side of the Alleghany mountains.

MR. ROBERT L. COOKE said:—The gentleman

who has just spoken, mentioned Pittsburgh as the Birmingham of America, and he hopes it will long retain that title. That does not seem to sufficiently express our regard or respect for this city; hence I propose, that instead, Birmingham should be called the Pittsburgh of England.

COL. W. MILNOR ROBERTS responded to the toast: "Our worthy Vice-President, who celebrates this Year, the Semi-Centennial of his professional Life."

He said:—I doubt whether any one here present, has proof of this statement. I am aware that yesterday, I parenthetically made such a remark, but it was accompanied with a request that it be not repeated. Surely no member here will credit it, for all know that I am one of the youngest of the American Society of Civil Engineers. When, however, I refer to certain events in my professional life, and attempt to date them, there seems to be truth in the statement.

In 1825, I began work as a civil engineer, and if I were to undertake to give even a bare summary of the various engineering labors I have performed in the fifty years which have elapsed, the whole might be insufficient.

During the last year I have, in the discharge of professional duty, visited the four quarters of the globe, and although this is the fiftieth year of my labors, I believe I am as able to do the work of an engineer as when I began; for then I had no experience whatever, and now I have a good deal of various kinds. Though I never considered myself a bridge engineer—for that now involves peculiar faculties and experience, and requires a bridge-building mind—there is a bridge (pointing to a model of the St. Louis bridge on the table) I was engaged on for two years, and nearly a half year on the piers and abutments (much of this time, in the caissons under the water).

Here I had the most interesting engineering experience of my life, and as this is a personal speech, I will say a word for the engineer who designed and constructed that bridge from beginning to end—James B. Eads. There may be errors in its plan or details, but in the grand and general conception, and in overcoming the various difficulties encountered in the prosecution of the work, he displayed rare and remarkable practical engineering ability. He is now engaged in another herculean undertaking, that of opening the mouth of the Mississippi. I believe he will succeed, and where now, there are but 9 feet of water over the bar of the South Pass, that within two years or less, there will be 30 feet. This opinion is founded on observations made in Europe during the

last year, as one of a Government commission charged with looking into the subject, as well as from personal knowledge of this and other rivers for many years. The importance of the undertaking I need not dwell on. Every one present knows, that unrestricted navigation from the deep water of the Mississippi to the ocean, is of vast consequence to the commerce of the West, and, indeed, of the whole country.

I will close by saying that during this half century of my professional life—of all the excursions I have made in different parts of the world—not one has surpassed in variety, profit or completeness the one we had to-day. Great credit is due to the gentlemen of the local Committee of Arrangements, and particularly to the Chairman, for what was so thoughtfully provided for our comfort and instruction; to them and through them, to the citizens of Pittsburgh. I desire in the name of the American Society of Civil Engineers to tender most hearty and sincere thanks.

MR. ALEXANDER L. HOLLEY (President of the Institute) responded to the toast: "The American Institute of Mining Engineers."

He said:—While the American Society of Civil Engineers, and the American Institute of Mining Engineers, have many features in common, there are points of dissimilarity; one of which, on the present occasion, appears to be that the civil engineers have cultivated the art of after-dinner speaking, which the mining engineers—it may be in consequence of their greater youth, have not; hence the remarks I have to make, perhaps, should be offered at a business meeting rather than on this convivial occasion.

The name—American Institute of Mining Engineers—does not fully convey an idea of the objects and purposes of the association. It is intended to promote the advancement, not only of mining, but also of the arts and sciences which are associated with the production of metals.

It seems to me if there are any two classes in the world which should be bound together by common professional interest, it is the producers and the users of metals. While the arts and sciences connected with the profession of civil engineering have been brought to a degree of perfection, which metallurgists, miners and chemists must acknowledge at every step; in my opinion, civil engineers do not fully appreciate the advantage to be derived from a more careful study by them, not only of the general principles, but of the working details of the production of metals. We, mining engineers, ask them to look further into the result of chemical and metallurgic combinations upon those physical

qualities which it is desirable should be embodied in metals; particularly would we call attention to the fact, that they have not heretofore given sufficient consideration to the possibilities and the economies of the metal manufacturer. When a man is first taken from an engineering school and put to work, it is expected that he will design some things that are not easily constructed, and some that cannot be made at all. I speak from experimental knowledge, having "been there." The judgment of the constructing engineer should be matured by the knowledge not only of the laws of his profession, but of the possibilities of the machine-shop and foundry; with these, he must also consider the requirements of transportation, erection and maintenance; that he may—by compromising between the difficulties surrounding any case in hand—design mechanism, which shall at the least, first and working cost, best accomplish the end in view. This is not always done; the exceptions may be few, but sometimes constructors have not only harassed iron and steel manufacturers, but they have defeated their own objects, by strictly adhering to engineering specifications, founded on engineering formulas, without regard to the metallic conditions of the case. It is therefore important that these two organizations should work together in harmony and for a common object.

When we consider the grand results of modern engineering; truss and arch bridges of 500 feet span, foundations pushed down through rapid rivers, machines almost human in their automatic operation, navies of ships steaming 15 knots an hour without closing a throttle for a fortnight's time, locomotives, lighthouses and breakwaters, waterworks, ship canals, tunnels and all the monumental engineering of the time; and then when we consider the gigantic strides of modern metallurgy, by means of which many of these engineering results have been rendered possible; the Bessemer process, in 1855 almost an abandoned experiment, in 1875 a million tons made by it; the Siemens Martin process, the offspring of a single decade and already the rival of the Bessemer; as well as the machinery by which a few boys perform the work of a regiment of men, and smooth like clay in the hands of the potter, ponderous and blazing masses of steel into infinite forms of utility; when we see the chemist prying open the molecules of matter, assaying and weighing its constituents, and the metallurgist by scientific synthesis reorganizing what the chemist has so skillfully dissociated; when we consider all of these splendid and co-

ordinate results of engineering and metallurgy, it seems to me that these associations representing them, may in the future, unitedly and with greater vigor press forward that great work to which they, more than all other agencies, have in the past contributed—the establishment and maintenance of the ways and means of civilization.

Mr. A. D. Briggs responded to the toast: "Railroads: their Relation to the State."

He said:—Doubtless, I am indebted for this compliment, to the fact that I am one of the Railroad Commission of the State of Massachusetts; but you ought to know that the business of that commission is divided; each member having a specific duty to perform, and for its proper discharge he is held responsible by his associates.

What is that division of labor, is of little interest to these here present, except that speech-making—especially midnight speech-making—is no part of mine. I feel at this time, like the little boy of frail physique who was called upon to engage in some difficult athletic exercise. He looked up and said, "Oh, I wish my big brother was here, he would show you how this thing ought to be done;" and so, if my associate were here, the Chairman of our Board, the great-grandson of one President, the grandson of another, and the son of a man who has received the highest honors the President can confer; with his three generations of inherited eloquence, he would show you how this thing should be done.

The relation of the railroad to the State is a subject of so great magnitude that at this time certainly, I should not undertake to discuss it; with three thousand millions of dollars invested, railroads seem able to take care of themselves, but in this period of general business depression, surely there is great need of caution in any attempt by the government to handle them. In some States, there seems to me, to have been but little done during the past few years, except to try and crush them out. I hope that a change in public sentiment for the better is coming over our people. The Chairman of our Board, last winter, delivered a lecture in Boston upon this very subject, every word of which I endorse. It has been published, and I will be glad to send a copy to any member of the profession asking for it.

I cannot, however, go home without expressing my satisfaction at the reception given to this association in Pittsburgh. I have passed through this city many times and seen but little except smoke, but I find that Pittsburgh does not begin or end in smoke. It is true that when visiting a portion of the city

yesterday, I saw some novel appliances for raising water, and heard how those machines had been introduced to the city; although I came from a section of the country where many believe that "God is too good to damn people, and people too good to be damned;" yet, then, my faith in universal salvation was sadly shaken.

As to-day, I went about the city and saw the great industries of Pittsburgh, more prosperous here than elsewhere on the continent at this time of general business depression, and as I listened to the remarks of Mr. Holley about converters and regeneration and all that sort, I thought of things inanimate as well as animate, and I shall go home to enjoy, as a townsman of his would say, "a feeling of true inwardness," and henceforth to be a happier and a better man than before.

MR. THOMAS BLAIR responded to the toast: "The Improvement of the Ohio River."

He said:—I would call attention to a fact which has to do with railroads only so far as it suggests that there is something else besides, and one which your Vice-President alluded to in his address before the Convention; it is that here we are at the head of a great system of navigation. Note this circumstance, and say whether anything can be shown like it. A single tow-boat took from Cincinnati to New Orleans, a distance of 1 600 miles, a tow of 550 000 bushels of coal, say 20 000 tons, and returned to Cincinnati with an equivalent number of barges; the expense of the whole was a little more than \$5 000; that is at the rate of 25 cents per ton for transportation 1 600 miles, or  $\frac{1}{8}$  cents a ton per mile. This is a fact so striking, that when told to Mr. I. Lothian Bell, then on a visit to this country, he, like Capt. Bunsby, made a note of it, and printed it in his report on the mining facilities of this country.

Now, if this has been done, possibly it may be bettered. Here is a land-locked navigation with no storms to encounter; the towing is easy, for the currents are not rapid down stream; while the other way, the barges are empty and about an acre of them may be drawn up the Mississippi by one boat; the fleet is bound together when started and only men enough are required to shovel coal under the boilers, and to manage that boat alone; the fuel, of course, is very cheap, and the cost of constructing these barges is small.

Fancy that from Pittsburgh to St. Louis, 1 200 miles, at every season of the year, except when interfered with by ice, we had a 6 feet stage of water, which is all that is necessary. Locks of some kind would be needed;

—suppose \$250 000 a year were allowed for maintaining them. The shipment of coal from Pittsburgh, in a favorable season, amounts to about 75 000 000 bushels, or 3 000 000 tons; at  $\frac{1}{8}$  cent per ton per mile, the rate per ton to St. Louis would be  $18\frac{3}{4}$  cents, and the lockage on that quantity at the aggregate cost named, would be about  $\frac{1}{2}$  cent more. I do not say this will be, but it is possible. I believe that within ten years, less than a dollar a ton will be the freight from here to St. Louis. I leave it with you, civil engineers, to solve this problem of so great importance relating to the material resources of this country.

PROF. S. P. LANGLEY responded to the toast: "The Sun, the great Motor."

He said:—The sun, as has been learned in late years, is a great motor. Everything we have here we are finding there—iron, copper and all other metals with which the metallurgist is familiar, are discovered in the sun, the source of all the power that is turning the rolls and driving the mills, and doing the work of the world.

I had the pleasure, some little time ago, of visiting an eminent engineer, Mr. John Ericsson, at his house, which he told me he had not left for five years, and did not mean to leave, until he was carried out in his coffin. He was absorbed in the study of the sun, a study, which seemingly so far remote from all practical affairs, is in the minds of many leading men of the day, intimately connected with them. There is in the rays of sunlight which fall on the deck of an ocean steamship, power sufficient to drive it across the Atlantic, at the speed now caused by steam engines of 3 000 or 4 000 horse-power. This illustrates the immense capacity to be developed by the engineer in the mere potency of the sun's rays.

Solomon has said, there was nothing new under the sun, but of late a great deal that is new has been found in it, and we hope that each coming year will bring our labors, apparently so remote, nearer and nearer to those of the practical man.

MR. CHARLES E. EMERY responded to the toast: "Steam Engineering."

He said:—We came here by steam, we travel on land and sea by steam, we are raised in this building by steam, our food is cooked by steam; and perhaps, if we are not speaking tonight by steam, it is by something quite like it. The steam engine has rendered possible much of the progress in all engineering, whether civil or mechanical.

During the war, I took part in some experiments which, on account of a change in ad-

ministration, were not finished; since I have tried to get at the root and bottom of the matter and have presented most of the results obtained, in a paper recently published in the Transactions of this Society. It is all resolved into this—at what cost may a given work be done; for what can a certain number of tons be transported from here to the sea by land or water, and then carried abroad—a question of economy which affects all sections of the country and classes of citizens. Here is bituminous coal in its richness, at another point is anthracite coal, not so rich; the two are brought directly into competition, as determining the cost of the marketable products of the mine and loom. The steam engine which largely consumes them is the controlling power to be considered, as far as economy is concerned. Without attempting details, it may be said that there is one general underlying principle; when we take something of intense nature in small quantities, the result is more cheaply obtained than when we take something less intense in larger quantities. So it is more economical to work the steam

engine with high pressures and small quantities rather than with lower pressures and larger quantities, though the product of the two would be the same.

For illustration, compare the steam engines which drive our ships across the ocean with the locomotives which draw our trains. In the one we have great weight of parts, and in the other high pressure of steam; they do nearly the same work at about the same cost. That exemplifies the principle spoken of; to carry it into general practice in the several branches of industry, belongs to steam engineering; to economize in metallurgical operations in mining and smelting the ore, in reducing it to iron and steel, as well as in the machinery that furnishes the power by which all this is done, is but one branch of its practice.

MESSERS. J. JAMES R. CROFTS, FRANCIS COLLINGWOOD and others responded to concluding toasts. Mr. Foster sang "Loch Nagarr"—the company sang "Auld Lang Syne"—and then separated.

## TREASURER'S STATEMENT

OF CURRENT RECEIPTS AND EXPENDITURES FOR QUARTER ENDING JULY 31ST, 1875.

	RECEIVED.	EXPENDED.
In May .....	\$359.05	\$332.06
" June.....	290.50	887.50
" July.....	906.45	1 017.62
Amounts.....	\$1 556.00	\$2 237.18
Amounts reported for half year ending April 30th....	5 974.76	4 878.43
Totals.....	\$7 530.76	\$7 115.61
Excess of receipts.....		\$415.15
Balance on hand November 1st, 1874.....		785.38
" " " August 1st, 1875.....		\$1 200.53

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Pennsylvania;—Tabulated Results compiled from Annual Reports of Railroads, Canal and Telegraph Co's for 1873. Harrisburgh. Penn. Western R. R. Company.—Statement of the Prospects. Advantages, Objects, Conditions and Workings. 1873. Philadelphia.

Railroad Progress; Transportation and Management. Springfield. 1873.

Relation of the Federal Government to the Railroads; a Review of the Controversy between the P. O. Dep't and Railways in respect to the so-called Postal Car Service. D. A. Wells. 1874.

Royal Saxonian Railroads; Time Tables—from May 1st, 1873. 2 vols. Dresden. (German.)

Shenandoah Valley R. R. Co.—Report of Herman Haupt, Chief-Engineer, and of J. P. Lesley, Geologist. Philadelphia. 1870. Toledo, Wabash & Western R. R.—Advantages of Settling along the Road. E. D. Mansfield. Cincinnati. 1875.

Transportation. Address by Edward Crane, Esq. February 13-18, 1868. Boston.

Twenty Years' War against Railroads. Western R. R. Association. Fourth Annual Report of Executive Committee. Chicago. 1872.

Wisconsin Railway Legislation.

## ANNOUNCEMENTS.

**MEETINGS:** The next stated meeting of the Board of Direction will be held Wednesday, September 1st, at 4 o'clock P. M., for the transaction of regular business.

The next regular meeting of the Society will be held Wednesday, September 1st, at 8 o'clock P. M., when ballots for members will be canvassed, the report of the Committee appointed at the Seventh Annual Convention on the "Policy of the Society" presented, and the resolutions of Mr. Croes, offered April 7th, relating to nomenclature in masonry and to the gauging of streams considered. The formal session will close at 9 o'clock, after which an hour will be given to conversation and social enjoyment.

The next stated meeting of the Society will be held Wednesday, September 15th, at 8 o'clock P. M., for social intercourse and professional improvement.

The new rooms of the Society are on the southeast corner of Broadway and Twenty-third street, nearly opposite Fifth Avenue Hotel, and overlooking Madison Square; entrance 4 East Twenty-third street. After September 1st—until further notice—they will be open from 9 o'clock A. M. to 9 o'clock P. M., except on Saturday, when they will be closed at 3 o'clock P. M. All the meetings of the Society are henceforth to be held at 8 o'clock P. M.

Members—particularly those from out of town—are invited to make these rooms their headquarters. Appointments with other parties may be kept here; and for such, and similar personal matters, a private room can now be had.

**TESTS OF IRON AND STEEL.**—Attention is called to the following circular recently issued:—preceding ones were published in July Transactions (Page 270).

IX. A committee of the Board \* \* \* has

been instructed to make a series of tests to determine the constitution, characteristics and special adaptations of steels used for tools.

As the results sought to be obtained are of public interest, the committee would request manufacturers of tool steels to aid in this work, by furnishing samples of their steel, to be subjected to mechanical, physical and chemical tests: one bar 4 feet long,  $2\frac{1}{2}$  by  $1\frac{3}{4}$  inches; one 4 feet long, 2 by  $1\frac{1}{4}$  inches; one 6 feet long, 1 inch round, and one 8 feet long,  $\frac{3}{4}$  inch hexagonal; to be stamped at one end with a distinguishing number and the trade mark and initials of the maker.

It is particularly requested that a full description of each bar, specified by number, be furnished, stating the kind of raw materials used, the processes employed in its manufacture, the size of ingot, number of reheats, and the extent to which it has been subjected to hammering or rolling. Its chemical analysis and the results of mechanical tests, with dimensions of the specimens broken, if such have been made, will also be of value to the committee.

Please state, also, at what heat each quality of steel submitted is best worked and hardened, the process of tempering recommended, the kind of cooling medium to be employed, and the color to which the temper should be drawn for tools intended for different purposes.

If it should be desired by the manufacturer to furnish one of his own men, familiar with and skilled in working the particular steel submitted, the committee would be pleased to accept his services.

Any suggestions in regard to the tests to which the steel or tools made of it should be subjected, will be thankfully received.

The bars are to be stored until the committee determines where they are to be sent.

DAVID SMITH, Chm. Com.

On Steel for Tools.

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### LIST OF MEMBERS.

#### ADDITION.

BACON, FRANCIS W. .... 10 Pemberton Square, Boston, Mass. .... August 10, 1875.

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#### CHANGES AND CORRECTIONS.

BISSELL, H. .... Box 2483, Cincinnati, O.

NADER, JOHN. .... Civil and Consulting Eng., Madison, Wis.

NICKERSON, LOUIS. .... Baltimore, Md.

PEARSONS, GALEN W. .... Constructing Eng., Bangor Water Works, Bangor, Me.

# AMERICAN SOCIETY OF CIVIL ENGINEERS.

## PROCEEDINGS.

### MINUTES OF MEETINGS.

(Abstract of such as may be of general interest to members.)

#### OF THE SOCIETY.

SEPTEMBER 1ST, 1875.—A regular meeting was held at 8 o'clock P. M.

The vote on admission to membership was canvassed and the following declared elected :—Members : Messrs. James K. Ford, of Oswego, N. Y. ; John Kennedy, of Montreal, Canada ; William H. Lotz, of Chicago, Ill., and Reuben Miller, of Pittsburgh, Pa. ; Associate, Mr. Arthur Beardsley, of Swathmore, Pa., and Junior Mr. Ambrose K. Michler, of Portsmouth, Pa.

A communication from Mr. Joseph S. Sewall, relating to the fall of a wooden bridge on the Northern Pacific R. R., near Brainard, Minn., was read.\*

The deaths—on July 17th, of Mr. T. Willis Pratt, a Member from November 2d, 1853 until the reorganization of the Society and a Fellow from November 4th, 1870 ; on July 26th, of Mr. Henry M. Gardner, a Member from December 1st, 1852, and on August 28th, of Mr. Edward H. Tracy, a Member from June 13th, 1868, were announced, and it was moved that for each a committee be appointed to present to the Society a memoir of the life and professional services of the deceased.

The Committee on the "Policy of the Society" not being prepared to report, the matter was laid over. The resolutions offered by Mr. Croes, April 7th, were taken up, considered and it was ordered that the question of the appointment of committees on the "Nomenclature of Masonry" and on the "Gauging of Streams," be submitted to the Society to be voted upon by letter ballot—the vote to be closed at the next Annual Meeting.†

SEPTEMBER 15TH, 1875.—A stated meeting was held at 8 o'clock P. M.

Communications from Mr. Jacob Reese, of August 20th and September 7th, with specimens of steel bars cut by his mechanism and of the

"cones" formed; from Mr. Walter Katté, of August 18th and Mr. E. S. Chesbrough, of August 30th, referring to the proper width of the tires of vehicles and to city laws regulating the matter, and from Mr. W. Sooy Smith, of September 8th, enquiring what action had been taken to present American engineering at the Centennial Exhibition in Philadelphia next year; also, a newspaper statement relating to the first water-works in the United States, were submitted and considered.

The formal session ended at 9 o'clock P. M., after which an hour was given to conversation.

### OF THE BOARD OF DIRECTION.

SEPTEMBER 1ST, 1875.—In the absence of a quorum, no stated meeting was held.

SEPTEMBER 13TH, 1875.—A special meeting, called by order of the President, to consider the Treasurer's reports and for the transaction of business, was held at 4 o'clock P. M.

The Treasurer's reports were presented and action thereon taken.

### NOTES AND MEMORANDA.

THE BRAINERD BRIDGE\* was, first a few bents of trestle-work, next a span of about 40 feet, then a span of 134 feet in the clear under the track, then an overhead span of 134 feet and a third span of 134 feet, with short span and trestling under the track. Its whole length was not far from 600 feet. The track was about 60 feet above low water; the long spans rested on 4 timber piers (cribwork) filled with stones to a little above high water mark, and about 20 feet of upper part of piers not filled.

These long spans were on the usual Howe truss plan, having each 14 panels of 9 feet 7 inches length, and 20 feet clear height between chords. The lower chord was of 4 strings ( $5\frac{1}{2} + 6\frac{1}{2} + 6\frac{1}{2} + 5\frac{1}{2}$ )  $\times 14$  inches packed with single oak clamps and oak keys. The first set of tie rods was 2 bars of  $1\frac{1}{2}$  inches round iron and 3 bars of  $1\frac{1}{2}$  inches, the screw threads cut out of iron without enlargement of ends; these dimensions were measured on the bridge. Other sizes are as follows: upper chords ( $5\frac{1}{2} + 6\frac{1}{2} + 6\frac{1}{2} + 5\frac{1}{2}$ )  $\times 12$  inches, main braces, two pieces  $8\frac{1}{2} \times 11$ , floor beams  $7 \times 14$  and 2 feet 5 inches apart, track stringers 2 pieces  $5 \times 12$  under each rail, lateral braces  $6 \times 7$ . Ties said to have been 12 feet long.

The train that broke the bridge was drawn

\* Presented September 1st, 1875.

by a 30-ton engine and tender and was made up of 10 flat cars next the engine (each loaded with about 25 000 pounds of steel rails), 12 box cars and caboose. It was running west 4 or 5 miles an hour and the engine got entirely across the bridge. A man living in a house about 100 feet from the west end of the bridge heard the steam let on in the usual way as the engine reached the end of the bridge, and immediately after a crash; running out he saw the west span falling and the middle span fall a few seconds after. The engine was dragged backwards and the east end of the train forwards into the wreck. The only brakeman was on the first box car, nearly in the middle of the train; he saw what he thought was a stick of timber fly up, then the train began to go down. He jumped on to the floor timbers at the west end of east span, which did not fall.

The pier at the west end of the west long span overturned away from the river, breaking off near the top of stone filling; the small span west of this pier dropped one end without breaking. The west long span which broke first, fell considerably down stream as also did the cars on it, the middle span fell vertically. The engine fell on the river side of the overturned pier, a little down stream and overturned down stream.

The lower chords of the high span are said to have been continuous with and framed into the upper chords of the spans at each side of it. The upper chord of the east span broke off near the head of the first set of main braces. This span retained its camber, appeared to be in perfect condition, and was so reported by one of the party examining the wreck, who climbed on to it.

The bridge was planned by Gen. Ira Spaulding, and built in 1871 by Messrs. Canda of Chicago. The timber was inspected. The broken timbers in the wreck were examined and none were found unsound. The bridge repairer of the road, who is well known as a careful and experienced man, employed for many years by the Milwaukee & St. Paul R.R., reports the bridge to have been in good condition when it broke. The weather had been very dry, without rain for several weeks. My opinion, or conjecture, has been that the lateral bracing of the west span failed or was broken, and the upper chord bent down stream for want of its support.

A paragraph from a St. Paul paper of August 22d, in reference to the matter, is as follows:—

"An accident occurred last Saturday on the new railroad bridge at Brainerd which is a positive confirmation of the theory of the cause of the calamity at that place a few weeks ago. It seems, that while all the rolling stock of the North Pacific R.R. is of the most approved style, a portion of the freight cars of a connecting road are of a very inferior and dangerous make in one particular. The brakes, instead of being attached to the platform of the car and thus receiving the benefit of the springs, are attached directly to the trucks. The consequence is, that they are constantly working loose and dropping to the ties, which has several times resulted in ditching trains. This was the nature of the accident last Saturday. As the train in question was crossing the new bridge the brake of one of the cars dropped, catching a tie, and before the train could be stopped, had torn out the ties for a distance of 10 or 12 feet. The new bridge being much stronger than any ordinary truss bridge, withstood the shock, and a repetition of the terrible calamity of a few weeks ago was averted."

J. S. S.

St. Paul, August 22d, 1875.

The following was presented by Mr. J. James R. Croes at the meeting of the Society, September 1st, relating to the resolutions offered by him, April 7th, 1875.\*

**NOMENCLATURE OF MASONRY:**—Col. William E. Merrill suggested the formation of the committee proposed by the first resolution. In common with most of us, he has been much bothered in preparing specifications, as to the proper way to designate masonry of various kinds. His desire was to get from the Society "an official recommendation of a

nomenclature for all kinds of stone under all circumstances, from rip rap, or random stone to the ornamental stones of first-class architecture. The committee should make an exhaustive report, which would include the corresponding French and German names; it should be illustrated, and should contain a description of the kinds of dressing, such as axed, hammered, rustic, crandelled, etc. These names, doubtless, differ in different sections, but it would be advantageous to establish uniformity."

I am not altogether prepared to ask for an official recommendation from the Society of a nomenclature, and the resolution is so worded as to leave that subject open. I think, however, that a report giving the information called for in the resolution will be of great value to the profession, and may lead to some uniformity of classification of masonry. It would certainly enable engineers in one part of the country to understand what those in another part meant to describe in their specifications, which is not always the case at present.

**THE GAUGING OF STREAMS:**—That a committee on this subject should be formed, was suggested to me by Mr. James P. Kirkwood a year ago, and a draft of a resolution therefor was handed to the Secretary shortly afterwards, but the matter was overlooked in consequence of the pressure of other business.

The importance of obtaining more extended and accurate information than now possessed, concerning the discharge from water sheds of known area, is so manifest that no argument is needed to prove it. The want of such information is felt by every engineer who is called upon to examine questions connected with water supply for towns, manufacturing purposes and improvement of navigation. The data which we possess for computations of such discharge are unsatisfactory in many ways. Results are given of gaugings of foreign streams, and in a few instances of measurements in our own country, but it is very rarely that any information is afforded in sufficient detail to enable an inquirer to form a competent judgment of the correctness of the means employed in obtaining the results, or of the peculiar circumstances affecting the flow of the stream measured. Almost every observer seems to use a method and formula "peculiar to himself;" too often in publishing the results obtained he omits altogether to state his method.

Doubtless, many boards and companies which use water, would, if the subject were properly placed before them, be willing to go to a small expense in procuring data which



could be depended upon, because made under the auspices of competent men and in a uniform manner. The supervision and direction of such observations, and their reduction into useful form, appears to me to come within the scope of this Society, and, indeed, to be carrying out in a special degree, one of the purposes of its establishment. The object of this preliminary committee is to enquire into the feasibility of carrying out such a project, and as the Smithsonian Institution and the Franklin Institute have successfully enlisted the co-operation of large numbers of observers in somewhat similar investigation, the resolution empowers the committee to consult with them. The committee should be composed of members who are interested in the subject, have had experience in it, and will be willing, if the project is feasible, to aid in the actual management of the operations necessary for carrying it out successfully.

**WIDTH OF TIRES OF VEHICLES:**—A member writes the Secretary: "Can you refer me to any data on the proper width of ties of vehicles, proportionate to the loads carried, and

have you any city law on that subject, or is there one elsewhere?"

Replies to these queries are requested from those having the information.

"THE FIRST WATER WORKS in the United States appear to have been planned and constructed by Mr. J. C. CHRISTENSEN at Bethlehem, Pa., in 1762. The machinery consisted of 3 single-acting force pumps, 4-inch calibre and 18-inch stroke worked by a triple crank, and geared to the shaft of an undershot water-wheel 18 feet in diameter and 2 feet clear in the buckets. The total head of water was 2 feet. On the water-wheel shaft was a wallower of 33 rounds, gearing into a spur-wheel of 52 cogs, attached to the crank. The piston rods were attached each to a frame or cross-head working in grooves, to give them a parallel motion with the pump. The cross-head was of wood, as well as the parts containing the grooves as guides. The water was raised by this machinery to the height of 70—and subsequently to 114 feet. The first rising main was made of gum wood, as far as it was subject to great pressure, and the rest was of pitch pine. In 1786 leaden pipes were substituted: in 1813 these were changed for iron. These works were in operation as late as 1832."

Definite and more detailed information in regard to the erection of this and other early water works in this country is desired.

#### NEW BOOKS ON

### ENGINEERING AND TECHNOLOGY.

Anchors, &c. Reports from naval Officers, and Papers relating to Anchors and Ships' Ground Tackle. Parliamentary Report. London. 6d.

Ancient Stone Crosses of England. Alfred Rimmer. London. 8vo, illus. *Virtue*. 9s.

Architecture: Discourses on—trans. from the French of Viollet-le-Duc, with Notes by Henry Van Brunt. Boston. 8vo, illus. *Copgood*. \$3.00.

Arithmetic: a Treatise on instrumental—or, Utility of the Slide Rule; designed as a Pocket Companion for the Mechanic, Manager and Operative, with full and complete Instructions for every Mechanic and Operative to make his own Calculations. New York. 48mo. *Bicknell*. (Announcement.) \$1.00.

—: the Slide Rule practically considered. N. P. Berg. 6th ed. London. *Spons*. (New York.) 5s.

Art: Lectures and Lessons on—being an Introduction to a practical and comprehensive Scheme. F. W. Moody. London. 8vo. *Bells*. 3s. 6d.

Astronomy, Handbook of—: Dionysius Lardner. 3d ed. rev. and ed. by Edwin Dunkin. London. 8vo, illus. *Lockwood*. 7s. 6d.

—, popular—containing how to observe the Heavens, Earth, Sun, Moon and Planets, Light, Comets' Eclipses, Astronomical Influences, &c. Dionysius Lardner. New ed. London. 8vo, illus. *Lockwood*. 4s. 6d.

Bees and White Ants: their Manners and Habits. Dionysius Lardner. New ed. London. 8vo, illus. *Lockwood*. 2s. 6d.

Birds of the Northwest: a Book of the Ornithology of the Region drained by the Missouri River and its Tributaries. Elliott Coues. 8vo. Washington.

Boiler Makers and Steam Users: Pocket Book for—comprising a Variety of useful Information for Employer and Workman, Government Inspectors, Board of Trade Surveyors, Engineers in Charge of Works and Ships, Foremen of Manufactories, and the general Steam using Public. Maurice John Sexton. London, 32mo, illus. *Spons*. (New York.) 5s.

Building Construction, Notes on—arranged to meet the Requirements of the Syllabus of the Science and Art Department of the Committee of Council on Education, South-Kensington. London. Philadelphia. 8vo, illus. *Lippincott*. \$3.50.

Calculus, an elementary Treatise on the Integral—containing Applications to plane Curves and Surfaces, with numerous Examples. Benj. Williamson. London. 12mo. (*Van Nostrand*, New York.) \$5.25.

—, Elements of the infinitesimal—with numerous Examples and Applications to Analysis and Geometry. James G. Clark. Cincinnati. 12mo. *Wilson, Hinkle & Co*. \$2.25.

Chemistry, Class Book of—: E. L. Youmans. New ed rev. New York. 12mo, illus. *Appleton*. \$1.75.

- , an Introduction to scientific — designed for the Use of Schools and Candidates for University Matriculation Examinations. 5th ed. F. S. Barff. London. 12mo. *Groombridge*. 4s.
- Chromatics. Prof. Rood. New York. *Putnam*. (Announcement.)
- Civil Engineer's Minutes of the Proceedings of the Institution of — with other selected and abstracted Papers. Vol. XLI. Session 1874-5. Part III. London. 8vo.
- Common Things explained, containing Air, Earth, Fire, Water, Time, Man, the Eye, Locomotion, Color, Clocks and Watches, Spectacles, the Almanac, &c. Dionysius Lardner. New ed. London. 8vo. illus. *Lockwood*. 5s.
- Cyclopædia, the American—Vol. XII. Mott to Pales. New York. 8vo. illus. *Appletons*. \$5.50
- Deep Diving. Capt. Falcon's Observations and Experience while engaged in — a Paper read before the Civil Engineers' Club of the Northwest. 12mo. Chicago.
- Education, Bureau of—Circulars of Information of the Bureau of Education, No. 6, 1875.—Statements relating to reformatory, charitable, and industrial Schools for the Young. Washington. 8vo.
- Electricity, Magnetism and Acoustics: Handbook of — Dionysius Lardner. New ed. rev. by George C. Foster. London, 8vo, illus. *Lockwood*. 5s.
- Engineer: Julius Weisbech, trans. from last German ed. by W. Nicodemus. New York. 2 vols. pocket size. *Wiley*. (Announcement.)
- Engineers: Information for colonial — E. A. by J. T. Hurst. No. 1. Ceylon. Abraham Deane. London. 8vo. *Spon*. (New York.) 2s. 6d.
- Lives of the — with an Account of their principal Works: including a History of inland Communication in Britain, and Invention and Introduction of the Steam Engine and Railway Locomotive; new and rev. ed. Samuel Smiles. London. 5 vols. 12mo. illus. Vol. I. Embankments and Canals—Vermuyden, Myddleton, Perry and Brindley. Vol. II. Harbors, Light-houses and Bridges—Smeaton and Rennie. Vol. III. History of Roads—Metcalf and Telford. Vol. IV. Steam Engine—Coulton and Watt. Vol. V. Locomotive—George and Robert Stephenson. *Scribner, Welford & Armstrong, New York*. \$12.50.
- Manual of local Marine Board Examination for Certificates of Competency as Second and First Class Engineers. Thomas Ainsley. 12th ed. with Supplement. 8vo., illus. London. *Stimpkin*. 7s. 6d.
- Etching and Engraving: a Treatise critical and practical. Philip Gilbert Hamerton. Boston. 8vo. illus. *Roberts*. (Announcement.)
- Exploration of the Colorado River of the West and its Tributaries: in 1869, '70, '71 and '72, under the Direction of the Secretary of the Smithsonian Institution. Washington. 4to. illus.
- Explosive Agents: Notes on certain — Walter N. Hill. Boston. 8vo. *Allyn*. \$1.00.
- Explosives: Researches on —: Fired Gunpowder. Capt. Noble and F. A. Abel. Philosophical Transactions of the Royal Society. London. 4to. illus. *Trubner & Co.* 11s.
- Fermentation: by Professor Schuetzberger. New York. *Putnam*. (Announcement.)
- Fish and Fisheries (United States Commission of). Part 1: Report on the Condition of the Sea Fisheries of the Coast of New England in 1871 and 1872. Part 2: Report of the Commissioner for 1874 and 1875. with supplemental Papers. Spencer F. Baird, Commissioner. Washington, 2 vols. 8vo. illus.
- Freetwork, Amateur's practical Guide to —, Wood, Carving, Marquetry, Buhlwork, Mitering Picture Frames, Lattice and Verandah Work, Staining, Varnishing, Polishing, and many Useful Receipts. Savoy. Cirencester. 8vo. illus. (*Kent, London*.) 2s. 6d.
- Gas, the quantitative Estimation of Ammonia and Sulphur in Coal Gas. W. W. Goodwin. Philadelphia. 12mo. illus. (*Van Nostrand, New York*.) \$0.50.
- Methods for Determining the Density and specific Gravity of Coal Gas. W. W. Goodwin. Philadelphia. 12mo. (*Van Nostrand, New York*.) \$0.25.
- Geography, the Elements of physical — a Text-Book for Schools, Academies and Colleges. E. J. Houston. Philadelphia. 4to. *Eldridge*. \$1.75.
- Geological Survey of England and Wales. Memoirs of — Explanation of Quarter Sheet 91 S. W. of the One-inch geological Survey Map of England and Wales, illustrating the Geology of the Country around Blackpool, Poulton, and Fleetwood. C. E. De Rance. London (English government publication.) 6d.
- Geology, Guide to the — of London and the Neighborhood, an Explanation of the Geological Survey Map of London and its Environs and of the Geological Model of London, in the Museum of Practical Geology. William Whitaker. London. (English government publication.) 1s.
- of the Weald (Parts of the Counties of Kent, Surrey, Sussex and Hants). William Topley. In Part from the Notes and MSS. of H. W. Bristow, W. T. Aveline, F. Drew, C. Gould and Le Neve Foster. List of Fossils revised by R. Ethridge. London. (English government publication.) 28s.
- popular Geology, containing Earthquakes and Volcanos, the Crust of the Earth and Pre-Adamite Earth. Dionysius Lardner; new ed. London. 8vo. illus. *Lockwood*. 2s. 6d.
- Heat, the Handbook of —, Dionysius Lardner; new ed. rev. and enl. by Benjamin Loewy. London. *Lockwood*. (Announcement.)
- Hydrostatics and Pneumatics, Handbook of — Dionysius Lardner; new ed. rev. and enl. by Benjamin Loewy. London. 8vo, illus. *Lockwood*. 5s.
- Insect, the — Julius Michelet. London. illus. *Nelsons*. (New York.) \$6.00.
- Iron and Steel; Journal of the Iron and Steel Institute. No. 1, 1875. London. 8vo.
- Description of Process for permanently preserving Iron from Rust. W. H. Sterling. San Francisco. 8vo.
- London, Golden Guide to — London. 8vo. illus. *Scribner, Welford & Armstrong, New York*. \$1.50.
- Longitude by lunar Culminations; read before the Essayons Club of the Corps of Engineers, March 22d, 1875. James Mercur. (No. 38, Papers Essayons Club.) 4to.
- Man; the native Races of the Pacific States of North America. Hubert Howe Bancroft. Vols. 3 and 4. New York. 8vo. *Appleton*, each \$5.50.
- Marine Mammals of the Northwestern Coast of North America, described and illustrated. C. M. Seaman. San Francisco. 4to. illus.
- Mechanics' Guide: a practical Handbook for the use of Engineers, Mechanics, Artisans, &c., comprising Arithmetic, Geometry,

- Mensuration, Velocities, Wheel Gearing, Screw Cutting, the Steam Engine and the general Principles of Mechanism, with a number of useful Recipes, and copious Tables for practical Use. William V. Shelton. London. 8vo, illus. *Griffen*. (Van Nostrand, New York.) \$3.75.
- Mechanics, Handbook of —. Dionysius Lardner; new ed. London. *Lockwood*. (Announcement.)
- ; Essay on the Disc and differential Motions, as applied to the Messrs. Fairbairn, Kennedy, and Naylor's roving Machines, with Rules and Calculations for the Bobbin, as a Follower and Leader, and its Adjustment to any Size of Rove; the Scroll, and how to make it, &c. Joseph Howell. London. 12mo, illus. *Simpkin*. 1s.
- Microscope, the—containing optical Images, magnifying Glasses, Origin and Description of the Microscope, microscopic Objects, the solar Microscope, &c. Dionysius Lardner; new ed. London. 8vo, illus. *Lockwood*. 2s.
- Mollusca; Contributions to the developmental History of —. E. Ray Lankester. Philosophical Transactions of the Royal Society. London. 4to, illus. *Trubner & Co.* 10s.
- Money and the Mechanism of Exchange. (Int. Series.) New York. *Appleton*. (Announcement.)
- Monuments, ancient History from —. Persia from the earliest Period to the Arab Conquest. William Vaux. New York. 12mo, illus. *Scribner*. \$1.00.
- Guide to the principal chambered Barrows and other prehistoric Monuments on the Islands of the Morbihan, the Communes of Locmariaquer, Carnac, Plonharnel and Erdeven, and the Peninsulas of Quiberon and Rhéims, Brittany. W. C. Lukis. Ripon. 12mo. *Johnson*. (*Simpkin, London*.) 1s. 6d.
- Music, on the Sensations of Tone as a physiological Basis for the Theory of Music. Hermann L. T. Helmholtz. Trans. from 3d German ed. by Alex. J. Ellis. London. 8vo. (Van Nostrand, New York.) \$8.00.
- Naturalists' Library—ed. by William Jardine. 42 vols. illus. by 1,300 colored Plates, with Portraits and Memoirs of eminent Naturalists. Vols. 1-4, British Birds; 5, Sun Birds; 6-7, Humming Birds; 8, Game Birds; 9, Pigeons; 10, Parrots; 11-12, Birds of West Africa; 13, Fly Catchers; 14, Pheasants, Peacocks, &c.; 15, Animals—Introduction; 16, Lions and Tigers; 17, British Quadrupeds; 18-19, Dogs; 20, Horses; 21-22, Ruminating Animals; 23, Elephants, &c.; 24, Marsupialia; 25, Seals, &c.; 26, Whales, &c.; 27, Monkeys; 28, Insects—Introduction; 29, British Butterflies; 30, British Moths, &c.; 31, Foreign Butterflies; 32, Foreign Moths; 33, Beetles; 34, Bees; 35, Fishes—Introduction and Foreign Fishes; 36-37, British Fishes; 38, Perch, &c.; 39-40, Fishes of Guiana; 41, Smith's Natural History of Man; 42, Gould's Humming Birds. London. 8vo, illus. *Chatto & Windus*. 189s.
- Natural Philosophy; Elements —. W. Thompson and P. G. Tait. Part I. Cambridge. 8vo. *Cambridge University Press*. 9s.
- for Schools. Dionysius Lardner. 4th ed., rev. and ed. by T. Oliver Harding. London. 8vo, illus. *Lockwood*. 3s. 6d.
- Optics. By Prof. Lommel. New York. *Putnam's*. (Announcement.)
- , Handbook of —. Dionysius Lardner. new ed., ed. by T. Oliver Harding. London. 8vo., illus. *Lockwood*. 5s.
- Painting, practical Guide to Scene Painting and Painting in Distemper. F. Lloyd. London. 8vo. *Rowney*. 10s. 6d.
- Papers; Abstracts of Engineering—in foreign Transactions and Periodicals; Minutes of Proceedings, Institution of Civil Engineers. Part III. London. 8vo.
- Patents, Report of the Commissioners of Patents for Inventions, 1874, with Plan of proposed Site for Patent Office Buildings. (Parliamentary Report.) London. 8vo. 1s. 2d.
- : Specifications and Drawings of —, issued from the U. S. Patent Office, for December, 1874, January, February and March, 1875. Washington. 8vo. 4 vols.
- Peat Works in Russia. William Anderson. Minutes of Proceedings, Institution of Civil Engineers. London. 8vo.
- Philosophy; Analytical Processes; or the primary principle of Philosophy. W. I. Gill. New York. 12mo. *Authors' Publishing Co.* (Announcement.) \$2.00.
- Elements of—comprising Logic and general Principles of Metaphysics. W. H. Hill. 3d. ed. rev. Baltimore, 16mo. *Murphy*. \$1.50.
- Photography; History and Handbook of —, trans. from the French of Gaston Tissandier. Ed. by J. Thompson. London. 8vo, illus. *Low Marston*. 6s.
- \* Physics and Politics. (International Scientific Series.) Walter Bagshot. 3d. ed. London. 8vo. *King & Co.* 4s.
- , Handbook of Animal—. Dionysius Lardner; new ed. London. 8vo., illus. *Lockwood*. 7s. 6d.
- , popular —: containing Magnitude and Minuteness, the Atmosphere, meteoric Stones, popular Fallacies, Weather Prognostics, the Thermometer, the Barometer, Sound, &c. Dionysius Lardner, new ed. London. 8vo., illus. *Lockwood*. 2s. 6d.
- Physiology; Animal—for Schools. Dionysius Lardner. 2d ed. London. 8vo, illus. *Lockwood*. 3s. 6d.
- Pile Driving in Wisconsin—(deep): a Paper read before the Civil Engineers Club of the Northwest. C. W. Durham. Chicago. Piles, on the Driving of—, to resist the Force of Ice tending to draw them from the Ground. John W. James. Minutes of Proceedings, Institution of Civil Engineers. London. 8vo.
- Pistol, as a Weapon of Defense in the House and on the Road—how to Choose and how to Use. New York. 16mo. *Industrial Publishing Co.* \$0.50.
- Plants, climbing— and their Habits. Charles Darwin. New York. *Putnam's*. (Announcement.)
- Powder, blasting —. Reports of her Majesty's Inspectors of Mines relating to the Use of blasting Powder in fiery Mines. (Parliamentary Report.) London. 8vo. 3d.
- Punctuation, a Treatise on—. Joseph A. Turner. Philadelphia. *Lippincott*. (Announcement.)
- Railroad Transportation, Cost of—, Railroad Accounts, and governmental Regulation of Railroad Tariffs. Albert Fink. Louisville. 8vo. (*Railroad Gazette, New York*.) \$0.50.
- Rifled Guns. Return in Continuation of Parliamentary Report. 380-74. London. 8vo. 5d.
- Science and Art. Museum of —. Ed. by Dionysius Lardner. etc. issue. London. 8vo. 6 vols. *Lockwood*. 21s.

- 22d annual Report. (Parliamentary.) London. 8vo. 4s. 6d.
- , Literature and Art. Dictionary of—, W. T. Brande and G. W. Cox. New ed. rev. London. 8vo. 3 vols. *Longmans*. 63s.
- , progressive Lessons in applied—, Part I. Geometry on Paper; Part II. Solidity, Weight and Pressure. Edward Sang. London. 8vo. 2 vols. *Spons*. (New York.) 6s.
- Scientific Instruction, Reports of Royal Commission. 5s. 3d. (Parliamentary.) London. 8vo. 6th Report, illus., 5s. 3d. 7th Report, 10d. 8th Report, 7d.
- Sea, the—. Jules Michelet. London. 8vo., illus. (*Nelson, New York*.) \$6.00
- Sound and its Phenomena. Dr. Brewer. London. 18mo. *Jarvold*.
- Staff College Exercises. 1874. Ed. by Col. Hamley. Edinburgh. 8vo. (*Van Nostrand, New York*.) \$1.75.
- Stair Builder's Guide, the American—. L. D. Gould. New York. 8vo, illus. (*Van Nostrand*.) \$5.00.
- Statistical Atlas of the U. S., based on the Results of the 9th Census, 1870, with Contributions from eminent Men of Science, comp. by Francis A. Walker. New York. folio. (*Van Nostrand*.) \$18.00.
- Steam and its Uses; including the Steam Engine, the Locomotive and Steam Navigation. Dionysius Lardner, new ed. London. 8vo, illus. *Lockwood*. 2s.
- a practical Treatise on the Science of— in Relation to the Economy of Fuel in modern Engines and Boilers. N. P. Burgh (to be published in 15 parts.) Parts I, II. London. (*Van Nostrand, New York*.) Per part, \$1.50.
- Engine, rudimentary Treatise on—, for Beginners. (Weale's Series.) Dionysius Lardner, new ed. London. 12mo., illus. *Lockwood*. 1s.
- Steel, Use of—, in Construction, Methods of Working, applying and testing Plates and Bars. J. Barba. Trans. from the French, with a Preface, by A. L. Holley. New York. 12mo, illus. *Van Nostrand*. (Announcement.)
- Studies, true Order of—. Thomas Hill. New York. 12mo. *Putnam's*. (Announcement.)
- Surveying, nautical—reprinted from Alston's "Seamanship." London. 12mo. *Griffen*. 2s. 6d.
- Surveys, mineral—a Paper read before the Civil Engineers' Club of the Northwest. A. A. Meyendorff. Chicago. 12mo
- Telegraph, the Electric—Dionysius Lardner, new ed. rev. and rewritten by E. B. Bright. London. 8vo. illus. *Lockwood*. 2s. 6d.
- , popularized; to render intelligible to All who can read, irrespective of any previous scientific Acquirements, the various Forms of Telegraphy in actual Operation. Dionysius Lardner. New ed. London. 8vo. *Lockwood*. 7s. 6d.
- Telegraphic Code, commercial—. W. S. Wetmore. 2d ed. London. 8vo. *King*. 42s.
- Tramways: their Construction and Working. J. Emerson and Alfred Dawson. London. 8vo. *Spons* (New York). 3s.
- Trigonometry, plane and spherical—and Mensuration. A. Schuyler. Cincinnati. 12mo. *Wilson, Hinkle & Co*. \$1.50.
- Volcanic Energy, Addition to the Paper on —, an Attempt to develop its true Origin and cosmical Relations. Robert Mallet. Philosophical Transactions of the Royal Society. London. 4to. *Trubner & Co*. 1s. 6d.
- War, the Surgeon's Pocket-Book, being an Essay on the best Treatment of Wounded in War. Surg.-Major J. H. Porter. London. 12mo, illus. (*Van Nostrand, New York*.) \$3.75.
- Franco-German; Operations of the German Engineers and technical Troops during —, published by Authority and in Accordance with official Documents, by Adolph Goetze. Trans. from German by Col. G. Graham. London. 8vo, with maps. (*Van Nostrand, New York*.) \$10.50.
- Water, Forms of — in Clouds and Rivers, Ice and Glaciers. John Tyndall. (International Scientific Series.) 5th ed. London. 8vo. *King*. 5s.
- Weather Report of the Meteorological Office, quarterly—published by the Authority of the Meteorological Committee. (English Government publication.) London. 8vo. 5s.
- Weights, Measures and Money of all Ages. F. W. Clarke. New York. *Putnam's*. (Announcement.)
- Zoology, first Book of —. Edward S. Morse. New York. 12mo. *Appleton*. \$1.25.

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Bulletins of the Public Library of the City of Boston, from April, 1868, to July, 1875.

From E. S. Chesbrough, Chicago, Ill.:  
Fourteenth Annual Report of the Board of Public Works of Chicago, for year ending March 31st, 1875.

From the Civil Engineers' Club of the Northwest, Chicago, Ill.

Papers as follows:

Deep Pile Driving by C. W. Durham: read February 2d, 1875.

Mineral Surveys, by A. A. Meyendorff, read May 4th, 1875.

Observations and Experience while engaged in deep Diving; Capt. Falcon's, read by E. S. Chesbrough, April 6th, 1875.  
Proceedings of the Sixth Annual Meeting, June 15th, 1875.

From J. B. Davis, Ann Arbor, Mich.:

First Annual Announcement of the School of Mines of the University of Michigan, 1875. (3 copies.)

From J. P. Davis, Boston, Mass.:

Report of the Cochituate Water Board to City Council of Boston, for year ending April 20th, 1875.

From Hon. C. Delano, Secretary of Interior, Washington, D. C.;  
Exploration of the Colorado River of the West and its Tributaries. 1875.

From the Editors and Publishers, New York:  
The American Cyclopædia. Vol. XII. Mott to Pales. 1875.

From the Essayons' Club, Willets Point, New York:  
Longitude by Lunar Culminations, by James Mercur, read March 22d, 1875.

From A. Fink, Louisville, Ky.:  
Annual Report of the President and Directors of the Louisville & Nashville R. R. Co., for year ending June 30th, 1874, with Tables.

From J. M. Goodwin, Cleveland, Ohio.:  
U. S. Patent Office. Specification for Improvement in Locomotives for burning Hydro Carbons.

From Institution of Civil Engineers, London:  
Excerpts from Minutes of Proceedings, Session 1874-5, vol. XLI, as follows:

Abstracts of Papers in foreign Transactions and Periodicals. Parts I, II and III—3 numbers.

Driving of Piles to resist the Force of Ice tending to draw them from the Ground: J. W. James.

Engineering in Sweden. Christer P. Sandberg.

Experiments on Portland Cement used in Portsmouth Dock Yard Extension Works; Charles Colson;

Hull Docks; Sir William Wright, and Albert Dock. J. C. Hawshaw.

Peat Works in Russia—W. Anderson.

Railway Management, comprising the following papers: I. The Working of Railways; G. Findlay. II. Sorting Railway Trains by Gravitation; Wm. Cudworth. III. Railway Statistics; J. T. Harrison; with abstract of Discussion, by J. Forrest.

Separate System of Sewerage in District of Tottenham and Middlesex in 1851-2. J. Pilbrow.

The use of Fascines in the Public Works of Holland. T. C. Watson.

Also—

Minutes of Proceedings, with other Selected and abstracted Papers. Vol. XLI. Session 1874-5. Part III.

From the Iron and Steel Institute, London:  
Journal of the Institute, No. 1, 1875.

From Jacob Reese, Pittsburgh, Pa.:  
Specimens of Steel Bars, cut with his Cold Cutting Disc, of the "Cones" and of German Spiegelheisen.

From W. P. Shinn, Pittsburgh, Pa.:  
Description of Process for permanently preserving Iron from Rust. W. H. Sterling. San Francisco. 1875.

From R. H. Thurston, Hoboken, N. J.:  
Annual Announcement of the Stevens Institute of Technology. 1875.

From John Whitelaw, Cleveland, O.:  
Nineteenth Annual Report of the Board of Trustees of Water Works, City of Cleveland, 1874. (2 copies.)

From Miscellaneous Sources:  
Cost of Railroad Transportation, Railroad Accounts and Government Regulation of Railroad Tariffs. A. Fink. Louisville. 1875.

Henderson's Hydraulic Brake for R. R. Cars—Descriptive Pamphlet. 1875.

National Self-Protection. Joseph Wharton. 1875.

Prospectus of the School of Bridges and Roads. Paris (French, 2 copies.)

Specifications and Drawings of Patents issued from the U. S. Patent Office for December, 1874, January, February and March, 1875. (4 volumes.)

## ANNOUNCEMENTS.

**MEETINGS:** The next stated meeting of the Board of Direction will be held Wednesday, October 6, at 4 o'clock P. M., for the transaction of regular business.

The next *regular* meeting of the Society will be held Wednesday, October 6th, at 8 o'clock P. M., when the report of the Committee appointed at the Seventh Annual Convention, on the "Policy of the Society," will be called for, and other matters of importance taken up.

The formal session will close at 9 o'clock, after which an hour will be given to conversation and social enjoyment.

The next *stated* meeting of the Society will be held Wednesday, October 20th, at 8 o'clock P. M., for social intercourse and professional improvement.

The Twenty-third Annual Meeting of the Society will be held Wednesday, November 3d, when the Annual Report of the Board of Direction on the Affairs of the Society, will be presented, officers elected for the ensuing year, the Norman Medal awarded and the time and place of the next (Eighth) Annual Convention determined.

The new rooms of the Society are on the southeast corner of Broadway and Twenty-third street, nearly opposite Fifth Avenue Hotel, and overlooking Madison square; entrance, 4 East Twenty-third street. Until further notice, they will be open from 9 o'clock A. M. to 9 o'clock P. M., except on Saturday, when they will be closed at 3 o'clock P. M. All the meetings of the Society are henceforth to be held at 8 o'clock P. M.

# AMERICAN SOCIETY OF CIVIL ENGINEERS.

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## PROCEEDINGS.

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### MINUTES OF MEETINGS.

(Abstract of such as may be of general interest to members.)

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#### OF THE SOCIETY.

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OCTOBER 6th, 1875.—A regular meeting was held at 8 o'clock P. M.

Photographs illustrating the Elbe bridge near Hamburg, North Germany, from Mr. C. O. Gleim, were exhibited and a communication giving description and details was read.

The death, on October 2d, of Gen. Ira Spalding, a Member from August 2d, 1870, was announced, and it was moved that a committee be appointed to present to the Society a memoir of his life and professional services.

The following from the Board of Direction was presented :

"Resolved, this Board hereby recommends to the Society for adoption that the annual assessment of a Resident Junior be \$15." The recommendation was accepted, and notice given, under Art. XXIII of the Constitution, that it would be called up for adoption at the next regular meeting of the Society.

Mr. Holley, Chairman of Committee on the "Policy of the Society," made verbal report, and asked leave to present a formal one at the Annual Meeting, action thereon then to be taken, which was granted.

The time and place of the Eighth Annual Convention was considered, and the Secretary and Chairmen of Library and Finance Committees were appointed to obtain by circular the votes of members, and to report the result at that meeting.

Messrs. John Schuyler, John Bogart and John Avery were named as Committee to arrange for a dinner at the Annual Meeting.

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#### OF THE BOARD OF DIRECTION.

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OCTOBER 6th, 1875.—A stated meeting was held at 4 o'clock P. M.

Proposals for admission to the Society were considered; action relating to annual assessment of Resident Juniors was recommended to the Society, and routine business transacted.



## REPORT OF COMMITTEE ON TESTING LABORATORY.

PRESENTED JUNE 10TH, 1875.

The Committee on a "Testing Laboratory" is enabled to report, that through the efforts of Prof. Thurston, and the liberality of the Trustees of the Stevens Institute of Technology, a beginning has been made, which promises eventually to grow into an important aid to mechanical researches.

January 30th, 1874, Prof. Thurston addressed a letter to the Trustees of the Institute, calling their attention to the need for a laboratory for technical research in this country, as expressed to him by officers of our important lines of railroads, iron and steel makers, manufacturers of machinery, and by civil engineers; and suggesting co-operation with business-men and others, to be benefited by such an institution. February 2d, in a letter to Prof. Thurston, Messrs. W. W. Shippen and S. B. Dodd, the Trustees, expressed their approval of the plan, and agreed to allow all necessary space in connection with the Institute, whether upon the grounds or within the present buildings. May 1st, these gentlemen wrote a second letter to Prof. Thurston, expressing the intention of assuming a more decided initiative, and authorized him to organize a mechanical laboratory in connection with the Stevens Institute of Technology, to serve as a nucleus for the proposed "Testing Laboratory," and to occupy, for the present, the necessary space in the existing building. The Trustees further transferred to this laboratory, sundry tools, apparatus and property, valued at \$5 000, and agreed to appropriate, in addition, a strip of land, 50 feet by 200 feet, estimated to be worth \$20 000, upon which to erect buildings for the future accommodation of the laboratory, whenever a total subscription sufficient for that purpose shall have been received.

Through this generous initiative, a nucleus for the laboratory is now organized and at work; it has been making such investigations as have been placed in its hands by the few who have hitherto known of its existence, and Prof. Thurston has lately received the well deserved compliment of the appointment of Secretary to the commission, named by the President of the United States, to make tests of American iron and steel.

The future development of this laboratory is now dependent upon two conditions. *First*—That those who desire particular investigations and experiments made, within its province, shall be advised of its organization, and shall give it their work, and: *Second*—That as the demands upon its capacity increase, further funds shall be provided for the necessary accessions to its apparatus, and eventually for buildings to be erected upon the grounds provided by the Institute.

This Committee has been in correspondence during the past year with a similar committee, appointed by the American Railway Master Mechanics' Association, with a view to devising some plan to obtain further subscriptions, and for the future enlargement of the laboratory. In consequence, however, of the present financial depression, and other difficulties connected with the subject, no definite course of action was agreed upon, and at the last annual meeting of the Association, a report from its committee was adopted, recommending the postponement for the present of any action upon this part of the proposal.

Under these circumstances, this Committee does not see its way to recommending any specific action on the part of the Society, and it may be best that any future enlargement and reorganization shall be the legitimate outgrowth of work and results to be accomplished with the present facilities, rather than now, to provide an expensive establishment, in advance of specific requirements.

The Committee, however, would call the attention of the individual members of the Society to the existence and working of this Testing Laboratory, and urge that those who have particular investigations to make, which they have not the necessary means for doing themselves, shall enter into communication with Prof. Thurston, with a view to placing such in his hands.

The correspondence between Prof. Thurston and the Trustees of the Stevens Institute of Technology, and a communication from Mr. W. A. Robinson, Chairman of Committee of the American Railway Master Mechanics' Association, are herewith submitted.

O. CHANUTE,  
Chairman.

## NOTES AND MEMORANDA.

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TESTS OF IRON AND STEEL.—Attention is called to the following from circulars—recently issued; others were referred to in July and August Proceedings (pages 270 and 284).

X.—The United States Board appointed to test Iron, Steel, &c., has instructed one of its committees to make a special investigation of the physical phenomena accompanying the distortion and rupture of materials.

It is believed that when a piece of metal of any kind is subject to strains, thermal, electrical and other physical phenomena are produced, which if closely observed, may indicate certain characteristics of the metals with great delicacy and perhaps with accuracy.

The committee appointed to conduct this branch of inquiry desires to receive suggestions from all whose tastes, experience or acquirements fit them to render aid in this special work.

The recent rapid progress of the physical sciences has supplied methods and appliances for accurate observations and measurements, of which we wish to take the fullest advantage. You are therefore, specially requested to favor the committee with descriptions and explanations of such methods of observation and experiment, and of such apparatus as you may think will prove valuable. Also, be kind enough to communicate such facts to the committee as you may have discovered bearing upon the subject of their inquiry and which you may be willing to make public in this way. For all such assistance, due acknowledgment will be made.

In thus addressing itself to scientific men, the committee would remind them of the national character of the work in which the Board is engaged, and will expect that that earnest desire to add to the common store of human knowledge, which characterizes all true lovers of science, will prompt a hearty co-operation and effective aid.

Any suggestions or information may be forwarded to the Chairman, or to any member of the committee, or to the President of the Board, Col. T. T. S. Laidley, at Watertown Arsenal, Watertown, Mass.

WM. SOOY SMITH, Chm. Com.  
on Physical Phenomena.

XI.—The Committee on Corrosion of Metals of the United States Board appointed to test Iron, Steel and other Metals is instructed "to

investigate the subject of the corrosion of metals under the conditions of actual use."

Its labors must necessarily consist largely in observing the corrosion that has taken place under these conditions and in collecting the results of observations and experiments made by others.

In this important part of its labors it asks the assistance of all whose tastes, interests or occupations have induced them to note the rate and mode of destruction (by corrosion) of the metals used in construction.

Full and clear statements are asked of all cases observed which show a remarkably rapid rate of corrosion or the reverse. It is very desirable, whenever practicable in these cases, to get a sample of the metal and of the scale or crust formed, for the purpose of chemical analysis. These samples you are respectfully requested to forward to Col. T. T. S. Laidley, President of the Board, at Watertown Arsenal, Watertown, Mass., accompanied by a full statement of all the conditions within your knowledge which have influenced the rate of corrosion in the particular case observed. The samples so forwarded will be carefully analyzed.

Important as the subject of the corrosion of metals is, the information touching it is so meagre and indefinite, that the rate of destruction cannot be predicted with certainty in any given case. You will confer a favor upon the committee by referring to such sources of information as you may deem valuable: such as reports of engineers, architects and scientists, or articles touching this subject contained in scientific publications.

Proper acknowledgments will be made of all assistance rendered.

WM. SOOY SMITH, Chm. Com.  
on Corrosion of Metals.

XII.—A committee of the United States Board appointed to test Iron, Steel and other Metals has been instructed "to arrange and conduct experiments to determine the laws of resistance of beams, girders and columns to change of form and to fracture."

This committee, desiring to attract to this branch of the inquiry the best talent and experience of the country, in order to reach results of the greatest practical value, solicits the aid and co-operation of all who manufacture or use beams, girders or columns.

Many experiments have been made by the rolling-mills engaged in the manufacture of wrought-iron beams, the results of which have doubtless been carefully recorded and tabulated. The committee earnestly asks copies of such records and tables. Engineers, architects and manufacturers have also made many experiments upon cast-iron beams and riveted wrought-iron struts and girders, the results of which are respectfully requested by the committee.

It is desirable that information as full as may be obtainable, with reference to the constitution and manufacture of the iron used in making the pieces tested, should accompany reports of experiments, especially chemical analyses of the metal where these have been carefully made.

The proportions of the various parts of the samples tested should be exactly given, and in all riveted work the size and position of the rivets should be clearly set forth. In all cases the modes of applying and measuring the strains should be given. Accurate cross-sections of the samples tested, drawn to scale large enough to admit of reliable measurements, will greatly facilitate a proper understanding and analysis of the results.

During the construction of the machinery ordered by the Board, the committee desires to collect information as above, and to make such experiments as seem practicable by the use of dead loads. For these experiments, and for those which will be made when the machinery is ready for use, manufacturers are asked to supply such beams, girders and columns as they may desire to have most carefully and impartially tested.

It may be of interest to those who are thus asked to contribute costly articles for destruction by tests, to be informed that the machinery ordered is believed to be the best yet designed for testing purposes, and to possess all the nicety and accuracy attainable with the present knowledge of machine construction. The first machine will have a capacity of 800 000 pounds; and this will be replaced by another of 2 000 000 pounds capacity at an early day.

All suggestions as to the kind of tests to be made and the manner of making them calculated to give them the greatest practical value, will be gladly received; and for these and all other assistance rendered, proper acknowledgments will be made.

Sample beams, girders or columns, furnished for test, should be stamped at one end with a distinguishing number, trade-mark and initials of the maker, and forwarded to Col. T. T. S. Laidley, President of the Board, at Watertown Arsenal, Watertown, Mass.

Reports of tests already made and all other information herein asked for, may be forwarded to the Chairman of this Committee, at Maywood, Illinois.

WAR. SOOY SMITH, Chm. Com.  
on Girders and Columns.

XIII.—In response to the first circular of this committee (IV. Page 271) a number of metal makers have sent specimens, which are undergoing duplicate analyses and preparation for various mechanical tests. The committee is most anxious to obtain, as soon as possible, a large number of iron and steel bars of *every variety of temper and quality*. It seems important to ascertain what chemical constituents, and how much of them make iron *bad*, as well as good; and what elements give it any peculiarities. The committee, therefore, is quite as anxious to get bars of *bad*, and especially of peculiar qualities, as to get standard specimens. Neither the chemists nor the experimenters will know who made the bars submitted to this series of tests, and no names will be published in connection with it. The apparatus of the Board will, in due time, be placed at the service of metal makers.

*The bars to be 7 feet long by 1½ inches round—each bar to be stamped on one end with a number and the initials of the maker.*

*A full description of the kind and make of raw materials, and of processes employed in the manufacture of the bars, and also of the size of the ingot or pile, the number of reheats, and the extent to which hammering or rolling were employed in the reduction, each description having a number corresponding with that of the bar, is particularly requested.*

Send bars as freight, with bill of lading, to Col. T. T. S. LAIDLEY, Watertown Arsenal, Boston, Mass.

For further information apply to Col. LAIDLEY, President of the Board, or to

A. L. HOLLEY, Chm. Com.  
on Chemical Research.

## NEW BOOKS ON

## ENGINEERING AND TECHNOLOGY.

Cements; Experiments on the Strength of—chiefly in Reference to the Portland Cement used in the Southern Main Drainage Works. John Grant. London. 8vo., illus. *Spons.* (New York.) \$4.00.

Climate and Time in their geological Relations, a Theory of secular Changes of the Earth's Climate, James Croll. (Reprint from London Ed.) New York. 12mo. illus. *Appletons.* \$2.50.

Coal Mining, a practical Treatise on ———. George G. Andre. Vol. I. London. 8vo., illus. *Spons.* (New York.) \$14.50. Do., Part 7. \$2.00.

Compass. The equatorial Needle, or a Compass which swings E. and W.; a magnetic Meridian Compass for Iron Ships; and some new Observations on Magnet Manipulation. W. A. Roos. London. 8vo. *Spons.* (New York.) \$0.20.

Geology; the Testimony of the Rocks, or Geology in its Bearings, on the two Theologies—natural and revealed, Hugh Miller. New ed. New York. 12mo. *Carter.* \$1.50.

Geometry on Paper. (Part I—Progressive Lessons in applied Science.) Edward Sang. London. 8vo. *Spons.* (New York.) \$1.25.

Horse Power Diagrams, Ireson's. London. *Spons.* (New York.) \$4.25.

Hydraulics—European Commission on the Danube, Maps of the Delta of the Danube—Comparative Plans of the River Mouth,

with Sections of the Arm of the Souline showing the recent Work of the Commission, after Plans of Sir Charles A. Hartley, Engineer in Chief. Published by the Commission in 1867. Leipzig. (French.) Large folio.

——— Memoir of the Construction of Works for Improving the Mouths of the Danube, executed by the European Commission, established under Art. 16, Treaty of Paris, March 30th, 1856. Leipzig. (French.) 4to, with Maps.

Money and the Mechanism of Exchange. W. Stanley Jecons. (International Science Series). New York. 12mo. *Appletons.* \$1.50.

Rifle Practice—Manual for ——— including Suggestions for Practice at long Range, with special Instructions for the Formation and Management of Rifle Associations, and for Team Shooting. George W. Wingate. 5th ed., rewritten. New York. *Church.* \$1.50.

Solidity, Weight and Pressure. (Part II—Progressive Lessons in applied Science.) Edward Sang. London. 8vo. *Spons.* (New York.) \$1.25.

Steamship (the), its Form, Strength and Propeller. John E. Williams. London. 8vo. *Spons.* (New York.) \$0.40.

Survey—Report of the Reconnoissance of the Black Hills of Dakota, made in 1874, by William Ludlow. Washington.

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From C. Bender, New York:  
Letter to President and Directors of the N. Y. Long Island Bridge Co., 1875 (referring to cantilever Bridges, &c.), with Lithograph—copies for distribution.

From the Department, Washington, D. C.:  
Monthly Report of the Department of Agriculture. August and September, 1875. Washington.

From C. O. Gleim, Hamburg, Germany:  
Elbe Bridge, near Hamburg—3 photographs.

From Sir Charles A. Hartley, London, England:  
Memoir of Construction of Works for Improving the Mouths of the Danube, executed by the European Commission, established under Article 16 of Treaty of Paris, March 30, 1856—with 3 maps. Leipzig. And large Atlas. (French.)

From Gen. A. A. Humphreys, Chief of Engineers, U. S. A., Washington:  
Report of Reconnoissance of the Black Hills of Dakota, made in 1874, by William Ludlow. Washington.

From F. C. Prindle, Philadelphia, Pa.:  
Catalogue of the American Dredging Company. September, 1875. Philadelphia. Copies for distribution.

From S. H. Shreve, Tom's River, N. J.:  
Proceedings of Commissioners on Rapid Transit of the City of New York. 1875.

From the Society of Engineers. London, England:  
Transactions of ——— for 1874. London.

From R. H. Thurston, Hoboken, N. J.:  
The Mechanical Engineer; an Address to the Graduating Class of the Stevens Institute of Technology. 1875. By R. H. Thurston. New York. 2 copies.

From Miscellaneous Sources:  
Canal Appraisers of the State of New York. Annual Report. February 18, 1870. Albany.  
East River Bridge. Report of John A. Roebeling to the New York Bridge Co. Brooklyn. 1870.

Journal of the Franklin Institute, Philadelphia—from January to December, 1868.  
Nassau Water Department. 12th Annual Report. City of Brooklyn, for 1871.  
Specifications and Drawings of Patents issued from the U. S. Patent Office, for April, 1875. Prospect Park, Brooklyn. 8th to 11th Annual Reports of the Commissioners. Brooklyn, 1868-71.

Report of Committee of Franklin Institute on Explosions of Steam Boilers. Part II. Containing Report of Strength of Materials employed in Construction of Steam Boilers. Philadelphia. 1837.

## ANNOUNCEMENTS.

**MEETINGS.**—An *adjourned* meeting of the Board of Direction will be held Wednesday, October 20th, at 4 o'clock P. M., to consider the Annual Report of the Board for the current year.

A *stated* meeting of the Society will be held Wednesday, October 20th, at 8 P. M., for social intercourse and professional improvement.

THE TWENTY-THIRD ANNUAL MEETING of the Society will be held Wednesday, November 3d, at 10 o'clock, P. M.

The Annual Report of the Board of Direction on the affairs of the Society, and the Report of the Committee appointed at the Seventh Annual Convention on the Policy of

Society, will be presented; the Norman Medal awarded; the time and place of the Eighth Annual Convention determined; ballots for members canvassed, and other regular business transacted.

An election of Officers for the ensuing year will be held; also an informal dinner for members of the Society and invited guests will be held in the evening.

A CIRCULAR has recently been sent to members, relating to time and place of the Eighth Annual Convention, asking them by reply to the Secretary to state their preference, and also to say if they will attend the Annual Meeting on November 3d, or join in a dinner that evening.

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### LIST OF MEMBERS.

#### ADDITIONS.

BEARDSLEY, ARTHUR [A.]	Prof. of Mechanics and Engineering, Swarthmore, College, Swarthmore, Pa.	September 21, 1875.
KEENNDY, JOHN	Ch. Eng. Harbor Commission, Montreal, Can.	" 13, "
MILLER, REUBEN	Crescent Steel Works, Pittsburgh, Pa.	" " "

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#### CHANGES AND CORRECTIONS.

CAMPBELL, JOHN C.	Ch. Eng. Dept. Public Works, City Hall, New York.
CROSBY, WILSON	116 Lexington Av., Brooklyn, N. Y.
DU BARRY, JOHN N.	Assistant to Pres. Penn. R.R. Co., 233 South 4th St., Philadelphia, Pa.
GREENE, GEORGE S.	467 West Twenty-third Street, New York.
KENNEDY, WILLIAM H.	Lock box 186, Pittsburgh, Penn.
PRINDLE, FRANKLIN C.	Sec'y & Eng. Am. Dredging Co., 10 South Delaware Av., Philadelphia, Pa.
READ, ROBERT L.	57 West Third St., Cincinnati, O.
SWAN, CHARLES H.	35 North Main Street, Providence, R. I.
WHINERY, SAMUEL	Div. Eng. Cin. Southern Ry., Chattanooga, Tenn.

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#### DECEASED.

SPAULDING, IRA	Late of New York.	October 2, 1875.
TRACY, EDWARD H.	" "	August 28, "

# AMERICAN SOCIETY OF CIVIL ENGINEERS.

## PROCEEDINGS.

### MINUTES OF MEETINGS.

(Abstract of such as may be of general interest to members.)

#### OF THE SOCIETY.

OCTOBER 20TH, 1875.—At a stated meeting, the topic announced for the evening, "Improvement of the Mouths of the Mississippi," was presented by W. Milnor Roberts, and discussed by William J. McAlpine and others.

Appointment of the following Committees was announced:—"to investigate the feasibility and propriety of organizing the Society as a Mutual Benefit Society to aid and benefit the families of deceased members" per resolution of April 7th, William E. Worthen, Samuel R. Probasco and J. James R. Croes; to present fit memoirs of the life and professional services of William L. Dearborn, George S. Greene and Alfred W. Craven,—of Henry M. Gardner, Julius W. Adams,—of Edward H. Tracy, John C. Campbell—and of Ira Spalding, W. Milnor Roberts; also of appointment of the Secretary on the Committee to prepare the Annual Dinner—in place of John Bogart, who declined to serve.

Communications of October 13th, and following, from Hon. Thomas A. Doyle, Mayor of the City of Providence, referring to the appointment by the Society of a committee to examine and report upon the system of sewerage adopted in that city, and reply of the President, were presented: after consideration it was resolved that the Society cannot undertake to nominate committees to serve private interests, and the Board of Direction was requested to transmit to the Mayor of the City of Providence the names of a number of experts from whom he might select the committee referred to.

NOVEMBER 3D, 1875.—THE TWENTY-THIRD ANNUAL MEETING was called to order at 11 o'clock A. M., President Adams in the Chair; the following were present during the session:—John T. Fanning, of Manchester, N. H.; S. Clarence Ellis, of Boston, George A. Kimball, of Somerville, Mass.; Theodore G. Ellis, of Hartford, Conn.; David M. Greene, of Albany; Julius W. Adams, Wilson Crosby, Thomas P. Kinsley, Charles C. Martin, Ralph G. Packard, William H. Paine and Samuel



R. Probasco, of Brooklyn; John Avery, Leonard F. Beckwith, Alfred P. Boller, John Bogart, John C. Campbell, O. Chanute, Francis Collingwood, Robert L. Cooke, Alfred W. Craven, J. James R. Croes, Charles E. Emery, Walton W. Evans, Quincy A. Gillmore, Charles K. Graham, George S. Greene, George S. Greene, Jr., George E. Harding, Charles M. Harris, Alexander L. Holley, Gabriel Leverich, Charles Macdonald, William W. Maclay, George S. Morison, James O. Morse, Charles H. Myers, W. Milnor Roberts, John Schnyler, William H. Searles, Henry W. Stuckle, Francis L. Vinton and William E. Worthen, of New York, and William W. Wilson, of Yonkers, N. Y.; Charles B. Brush and De Volson Wood, of Hoboken, Richard D. Dodge, Charles D. Ward and Lebheus B. Ward, of Jersey City, Ashbel Welch, of Lambertville, James Christie, of Phillipsburgh, and Samuel H. Shreve, of Toms River, N. J.; Robert Briggs and Moncure Robinson, of Philadelphia, and James Archbald, of Scranton, Pa.; William R. Hutton, of Baltimore, Md., and Martin Coryell, of Richmond, Va.

The Annual Report of the Board of Direction<sup>1</sup> on the affairs, and of the Treasurer on the finances, of the Society were read and accepted.

The Treasurer announced after reading his Report, that he would be unable to serve longer in that capacity, the President and Vice-Presidents were instructed to express the appreciation of the Society of the vigilant, faithful and sacrificing service rendered by James O. Morse as Treasurer, the same to be published with his Report.

Moncure Robinson, senior Honorary Member of the Society, was introduced to the meeting by the President and made remarks upon his experience in the early practice of civil engineering.

The vote on admission to membership was canvassed and the following declared elected:—Members, William H. H. Benyaurd, of Corps of Engineers U. S. A., and G. Clinton Gardner, of Altoona, Pa.; and Juniors, Thomas J. Long and Robert P. Staats of New York and W. Marshall Rees of Stockton, Pa.

At the same time, the vote ordered September 1st<sup>2</sup> to determine whether committees on the "Nomenclature of Masonry" and on the "Gauging of Streams," by resolution adopted April 7th,<sup>3</sup> should be appointed, was canvassed: the result being 107 to 5 for the former and 100 to 7 for the latter.

The Society proceeded to elect officers for the ensuing year, ballots were taken and the following declared elected:—George S. Greene, President; Theodore G. Ellis and W. Milnor Roberts, Vice-Presidents; Gabriel Leverich, Secretary; John Bogart, Treasurer; Octave Chanute, Alexander L. Holley, Francis Collingwood, Quincy A. Gillmore and Julius W. Adams, Directors.

A recess was then taken and the meeting called to order again at 3½ o'clock P. M.

The President, for the Board of Censors to award the Norman Medal, reported that of the papers submitted, one entitled "Description and

<sup>1</sup> Page 303.

<sup>2</sup> Page 285.

<sup>3</sup> Page 210.

Results of hydraulic Experiments with large Apertures, at Holyoke, Massachusetts, in 1874," was most worthy; the accompanying sealed envelope was opened and Theodore G. Ellis, of Hartford, Conn., was declared the successful competitor.

Reports of Committees on "Tests of American Iron and Steel," William Sooy Smith, Chairman<sup>1</sup>; on "Change of the Society's Rooms," John Bogart, Chairman<sup>2</sup>; on "Time and Place of the Eighth Annual Convention," G. Leverich, Chairman," and on a "Mutual Benefit Society," William E. Worthen, Chairman<sup>3</sup>, were presented and accepted: it was fixed that the Convention should be held in Philadelphia, June 13th, 14th and 15th, 1876; and the Secretary was requested to ask by circular each Member and Junior whether he will become a member of a Civil Engineer's Insurance League, formed on the basis recommended in the last named report.

The Committee on "Policy of the Society," Alexander L. Holley, Chairman, made a report<sup>4</sup> embodying amendments to the By-Laws, and after debate by J. James R. Croes<sup>5</sup>, and others, the report was accepted.

This was offered as an additional By-Law,<sup>6</sup>: applications to the Society for professional service shall be referred to the President to nominate members whom he may deem suited to perform the duties required, such nomination and whether the matter be considered shall then be acted on by the Board of Direction; and was amended so that thrice the number required for any committee shall be named, from whom selection may be made by the party applying.

The following was offered as an amendment to By-Laws, Section 16: In case a paper be presented to the Society that the Library Committee does not feel authorized to publish on account of the expense, the Committee shall prepare an abstract of such paper and submit the same to the writer, which abstract, when approved by him, may be published instead of the original paper.

After consideration all the amendments proposed were referred to the Board of Direction with instructions to report them at the next regular meeting, with such changes as may seem proper.

As recommended in meeting, October 6th,<sup>7</sup> the annual assessment of a Resident Junior was fixed at \$15.

Communications<sup>8</sup> from William Sooy Smith of September 8th and October 22d, from Henry Pettit of October 15th, and from James H. Harlow of October 19th, referring to action of the Society to provide for representation of American engineering at the Centennial Exhibit on in Philadelphia were read, the matter was discussed, and it was determined to appoint a committee of seven members, to consider the subject, with power to appoint sub-committees to prepare memoirs, and to arrange for the exhibition of plans, models and specimens, showing the progress in this country of engineering in its several branches. During the discussion it was stated that the American Institute of Mining Engineers

<sup>1</sup> Page 314. <sup>2</sup> Page 315. <sup>3</sup> Page 316. <sup>4</sup> Page 317. <sup>5</sup> Page 319. <sup>6</sup> As recommended by the Board of Direction, page 313. <sup>7</sup> Page 293. <sup>8</sup> 319.

had taken action in a similar direction, relative to mining and metallurgy, and raised by personal subscription funds sufficient to defray the necessary expenses.

A communication from Clemens Herschel of November 2d, was read, referring to the adoption of the metric system of weights and measures, and proposing that whether the Society petition Congress to fix a date—say three years hence—when such shall be the only legal system, be submitted to vote of members by letter ballot; after discussion by John Bogart, Robert Briggs, J. James R. Croes, Theodore G. Ellis and others, the matter was laid on the table.

NOVEMBER 17TH, 1875.—A stated meeting was held at 8 o'clock p. m.

A paper giving account of the "Construction of a River Wall at foot of Canal Street, N. R.," by William N. Radenhurst, C. E., and John D. Van Buren, Jr., C. E.—a contribution to the Annual Convention under head of "Docks and Wharfs"—was read and discussed; and "A Note on the Resistance of Materials," by Prof. Robert H. Thurston was read.

The formal session ended at 9 o'clock p. m., after which an hour was given to conversation.

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#### OF THE BOARD OF DIRECTION.

OCTOBER 20TH, 1875.—A meeting was held at 4 o'clock p. m.

Preparation of the Annual Report of the Board was considered; what should be done by the Society to represent American engineering at the Centennial Exposition in Philadelphia was discussed, and the Secretary was instructed to issue a circular to engineers and manufacturers, members of the Society, with a view to secure a concert of action therefor.

The President set forth the desirability of a change in the conditions of award of the Normal Medal,\* and he was requested to confer with the donor, regarding the matter.

A session was held in the evening, at which the resolution of the Society,† referring to the appointment of a committee to examine and report upon the sewerage system of the city of Providence was presented, and action thereon taken.

OCTOBER 27TH, 1875.—An adjourned meeting was held at 4 o'clock p. m., for preparation of the Annual Report of the Board.

NOVEMBER 4TH, 1875.—A meeting pursuant to Art. III of the Constitution was held at 4 o'clock p. m.

On motion, the President appointed Standing Committees for the ensuing year as follows:—on Finance, W. Milnor Roberts, Quincy A. Gillmore and Francis Collingwood, and on Library, Alexander L. Holley, John Bogart and Theodore G. Ellis.

The hour of meeting was changed to 3 o'clock p. m.

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\* See Annual Report, page 310.    † Page 299.

## THE

## ANNUAL REPORT OF THE BOARD OF DIRECTION.

ACCEPTED NOVEMBER 3D, 1875.

The Board of Direction, in compliance with Art. XII of the Constitution, herewith presents a "Report on the affairs of the Society, embracing the Report of the Treasurer" for the year ending this day:

On November 4th last, the membership was—

Honorary Members resident,	2—	Non-resident,	5—	total	7
Members	"	107—	"	247—	" 354
Associates	"	5—	"	10—	" 15
Juniors	"	2—	"	5—	" 7
		116		267	376
Fellows, 74—of whom 12 were Members and 1 Honorary Member—leaving					61
Total then connected with the Society					444

To-day the membership is—

Honorary Members resident,	2—	Non-resident,	5—	total	7
Members	"	105—	"	266—	" 371
Associates	"	5—	"	13—	" 18
Juniors	"	9—	"	27—	" 36
		121		307	425
Fellows, 72—of whom 11 are Members, and 1 Honorary Member—leaving					60
Total now connected with the Society					492
On November 4th last, the number of proposals and applicants for admission to the Society was					21
The number of proposals and applicants during the year was					71

Total acted on..... 92

Of this number 27 were elected as Members, 3 as Associates and 29 as Juniors; 2 declined to accept classification, 9 applications were laid on the table, and 20 are pending:—of those who were elected, 1 Associate and 7 Juniors were proposed as Members, and 1 Associate as Junior. 1 Member and 2 Juniors elected before November 4th last, and 23 Members, 3 Associates and 27 Juniors elected during the year, have qualified.

The increase during the year has been—

Members 24—less 7 deceased (one of whom was Fellow also)	17
Associates	3
Juniors	29
	49
Less 1 Fellow deceased	1
	48

21 meetings of the Society were held during the year, one of which was the Seventh Annual Convention; 11 were "regular meetings," at

which ballots for members were canvassed and other business done, and 9 were "stated meetings," when papers were read and discussions had upon engineering subjects and generally time given for conversation.

After trial during the preceding winter, at the annual meeting November 6th, 1872, it was ordered that the stated meetings be held in the evening, which was done until removal to the rooms now occupied by the Society. The attendance thus secured, and frequent requests of members, caused the Board then to recommend that the regular meetings also be held in the evening, which has since been done; and although this is not so convenient for some residents, the number of members present at these meetings has increased, particularly of non-residents.

11 stated and 5 special meetings of the Board were held during the year. On May 10th, the time of the stated meetings was changed to 4 o'clock P. M. of the first Wednesday of the month, being the day of the regular meetings of the Society.

The Seventh Annual Convention was held at Pittsburgh, June 8th, 9th and 10th, accompanied by visits to public works and prominent manufacturing establishments in and about that city, and an excursion to the oil regions of Butler Co., Pa. Separate sessions for the consideration of professional subjects and the transaction of regular business were held, minutes of which have appeared in Proceedings.

During the previous Society year, the purposes and results of Annual Conventions were considered with a view to deduce therefrom something which should tend to give these assemblages a more distinct and useful character; reports thereon were presented September 3d\* and December 2d,† and rules recommended, referring to the management of Annual Conventions were adopted; in accordance with which, a list of topics to be considered at the Convention with references to the Papers and Reports treating thereon, published in Transactions the year preceding, was duly submitted to members,‡ the topics were called for discussion in regular order and none but short papers were read. The practical comments of members upon published papers of the Society are now being printed in Transactions, and the result of this innovation upon previous usage seems to warrant continuance of the plan.

In business session the Convention recommended the passage of this additional By-Law—which, with other matters then considered, was duly referred to a committee on "Policy of the Society."

(Section—.) A Convention of the Society for professional discussion and social intercourse, shall be held annually, at such point as the Society shall determine, and be presided over by a Chairman elected from among Members not officers of the Society; during the Convention a business meeting shall be held, when the business of the Society may be transacted; said meeting to be held as a regular meeting of the Society.

Papers were presented to the Society during the year as follows:

Memoirs of the construction of a Masonry Dam. J. James R. Croes.

Principles of Construction of revolving Draw Bridges. Clemens Herschel.

Compound and Non-compound Engines, Steam Jackets, etc. Charles E. Emery.

\* Page 133.

† Page 172.

‡ Page 232.

Approximate Determination of Stresses in the Eyebars Head. William H. Burr.  
 Fabrication of Beton Coignet by manual Labor. Schuyler Hamilton.  
 Delta of the Mississippi considered in Relation to an open River Mouth. John G. Barnard.  
 Waves of Translation that emanate from a submerged Orifice. Clemens Herschel.  
 Consumption and Waste of Water delivered by public Works. James H. Harlow.  
 Levees. George W. R. Bayley.  
 Construction of a River Wall at foot of Canal Street, New York. John D. Van Buren, Jr.,  
 and William N. Radenhurst.  
 Improvement of the Mouths of the Mississippi. W. Milnor Roberts.

Reports have been made to the Society during the same time, as follows:

Annual Report of the Board of Direction for the Year ending November 4th, 1874.  
 On Revision of the Constitution and on Securing a national Recognition of the Society (2 reports), and  
 Award of the Normal Medal. Julius W. Adams, Chairman.  
 On Time and Place of the Seventh Annual Convention. Alfred P. Boller, Chairman.  
 On Tests of American Iron and Steel (2 reports). W. Sooy Smith, Chairman.  
 On Change of the Society's Rooms (2 reports). John Bogart, Chairman.  
 On Plan for the Increase, Maintenance and Preservation of an Engineering Library and Museum (2 reports). G. Leverich, Secretary.  
 On Comparative Examination of the principal pumping Engines in Use (2 reports). Gorham P. Low, Jr., Chairman.  
 On Founding a testing Laboratory (2 reports). O. Chanute, Chairman.  
 On Annual Conventions. G. Leverich, Chairman.  
 On Rapid Transit and the Handling of Freight in New York. O. Chanute, Chairman.  
 On Means of averting Bridge Accidents (4 reports). James B. Eads, Chairman.  
 On Form, Weight, Manufacture and Life of Rails. A. Welch, Chairman.  
 On Railway Signals. J. Dutton Steele, Chairman.  
 On Policy of the Society. Alexander L. Holley, Chairman.

Discussions were had on many of these papers and reports when read before the Society; also on the following subjects:

American and European Railway Systems contrasted.  
 Cements and Concretes.  
 Education of Civil Engineers.  
 Efficiency of Furnaces burning wet Fuel.  
 Erection of Structures.  
 Failure of the Bridge near Brainard, Minn.  
 Fires in Coal Mines.  
 Foundations.  
 Gauging of Streams.  
 Levees of the Mississippi.  
 Nomenclature of Masonry.  
 Proportions of the Heads of Eye Bars.  
 Rainfall and the resulting Water Supply.  
 River Mouths.  
 Theory of Flexure.  
 Upright Arched Bridges.

Most of these papers, reports and discussions have been published in Transactions for the current year: also the following papers presented last year:

Erection of the Illinois & St. Louis Bridge. Theodore Cooper.  
 Education of Civil Engineers. Thomas C. Clarke.  
 Levees of the Mississippi River. Caleb G. Forshey.  
 Efficiency of Furnaces burning wet Fuel. Robert H. Thurston.



The following is a list of papers presented to the Society which are unpublished; some are quite brief, and possess but little interest at this time.

Relief of Broadway, including the Widening and Extension of Church and Mercer Streets—J. Laurie.....	January 5, 1853.
Use and Abuse of Iron, as applied to Building Purposes—H. M. Gardner.....	April 6, 1853.
Rebuilding an Aqueduct on the Morris Canal—W. H. Talcott.....	Dec. 7, 1853.
Comparative Economy of the Inclined Plane and Steam Locomotives on Railroads—W. H. Talcott.....	April 7, 1854.
Flat Iron Bands used as a Substitute for Wire Rope on the Inclined Planes at Mauch Chunk—A. W. Craven.....	January 5, 1855.
Wire Rope and the comparative Merits of the English and American Article—W. H. Talcott.....	January 5, 1855.
Experiments on the Strength of Cast Iron—W. H. Talcott.....	March 2, 1855.
Experiments on the relative Strength, Cost, &c., of Lead Pipes and Lead Pipes lined with Tin—G. S. Greene.....	January 15, 1868.
Failure of Tin lined Lead Pipe—McRee Swift.....	February 27, 1868.
Value of Union and Association in giving Position to our Profession—J. W. Adams.....	February 29, 1868.
Steam Engine Indicator—F. W. Bacon.....	April 1, 1868.
Change in the Location of the Boston, Hartford & Erie Railroad, near Fishkill—J. J. R. Croes.....	April 15, 1868.
Engineering Architecture—A. P. Boller.....	May 6, 1868.
Description of a Line of Water Mains, laid by the Croton Aqueduct Department, and an Enquiry into the Causes of the Failure of a Few of Them—Discussion—J. F. Ward.....	May 6, 1868.
Speed of Passenger Travel—M. Coryell.....	August 15, 1868.
Asphalt Streets of Paris—A. Beckwith.....	February 3, 1869.
Estimate Diagrams—J. R. Gilliss.....	April 21, 1869.
System of laying out Turnouts—J. M. Clark.....	June 16, 1869.
Bridge Foundations—M. Coryell.....	June 16, 1869.
Railroad Improvements—J. J. Shipman.....	June 16, 1869.
Niagara Falls Suspension Bridge—S. Keefer.....	January 19, 1870.
Route for a Ship Canal across the Central American Isthmus—J. W. Adams.....	February 16, 1870.
Columbia Coal Pockets—C. Macdonald.....	March 2, 1870.
Inter-Oceanic Canal across the Isthmus of Panama—J. C. Campbell....	March 14, 1870.
Inter-Oceanic Communication, Informal Paper—J. W. Adams.....	March 16, 1870.
Description of a Wharf built at Fort Wadsworth—J. G. Barnard.....	June 15, 1870.
The Aneroid Barometer and its use in Measuring Altitudes—Discussion—E. P. North.....	January 4, 1871.
Address of the Vice-President—J. W. Adams.....	June 21, 1871.
Well Boring for the Foundations of New York Pier of the East River Bridge—F. Collingwood.....	November 15, 1871.
Record of Pile Driving on the Seekonk River, Providence, R. I.—J. A. Monroe.....	December 20, 1871.
Investigation to determine the Amount of Air required for Respiration and Combustion in the West Caisson, New York Bridge—F. Collingwood.....	February 7, 1872.
Strains of a Triangular Roof Truss, and the use of Counter Braces in Bridges—C. Macdonald.....	February 7, 1872.
Tehuantepec Ship Canal—E. A. Fuertes.....	February 21, 1872.
Propping a Tunnel on the Chesapeake & Ohio Railroad—H. D. Whitcomb.....	April 17, 1872.
Life and Services of Edwin F. Johnson—W. M. Roberts.....	May 1, 1872.
Rail Economy—C. P. Sandberg.....	June 19, 1872.
Description of the International Bridge at Buffalo—C. S. Gzowski....	October 2, 1872.
Coal Cutting Machinery in England, including Comments—T. G. Smith.....	November 6, 1872.
Alcohol as an Illuminator of Caissons—F. Collingwood.....	November 6, 1872.

Coal Cutting Machinery, Discussion on—J. D. Steele.....	November 20, 1872.
Coal Cutting Machinery, Discussion on—M. Coryell.....	November 20, 1872.
Rock Drilling—F. Collingwood.....	January 8, 1873.
Manufacture of Pneumatic Files—R. Cartwright.....	February 19, 1873.
Screw Files—C. D. Ward.....	February 19, 1873.
Proportion of Pins used in Bridges—C. Bender.....	February 19, 1873.
Rail Economy, Reply to Discussion—C. P. Sandberg.....	March 5, 1873.
Leakages in Water Pipes—J. Whitney.....	March 19, 1873.
Statement of the Adaptation of mechanical Power to the Work of charging and discharging Gas Retorts—T. F. Rowland.....	March 19, 1873.
Tests of wrought Iron Beams and Rods—T. G. Smith.....	January 9, 1874.
Tests of Bridge Irons and Description of testing Machines—W. S. Smith.....	January 16, 1874.
Effects of Cold on Iron and Steel Rails—A. D. Briggs.....	January 17, 1874.
Experiments on the tensile Strength of Steel Wire—T. C. Clarke.....	January 19, 1874.
Review of Revy's "Hydraulics of Great Rivers"—W. M. Roberts.....	April 15, 1874.
Construction of the Williamsburg Reservoir—E. C. Davis.....	June 10, 1874.
Underground Drainage in New York—J. Avery.....	June 10, 1874.
Accident in Syracuse, occasioned by an improperly constructed Roof Truss—H. W. Clarke.....	September 6, 1874.
Tests of Eye Bars for Iron Bridges on the Erie Railway—R. H. Curtis.....	December 12, 1874.
Approximate Determination of Stresses in the Eye Bar Head—W. H. Burr.....	February 17, 1875.
Levees—G. W. R. Bayley.....	June 10, 1875.
Consumption and Waste of Water delivered by Public Works—J. H. Harlow.....	June 10, 1875.
Upright Arched Bridges, Discussion—S. H. Shreve.....	July 8, 1875.
Improvements in Rivers—W. J. McAlpine.....	October 20, 1875.
Improvement of the Mouths of the Mississippi—W. M. Roberts.....	October 20, 1875.

In addition to these are several reports of committees, upon a number of subjects, which are unpublished.

During the year "Transactions" have been published monthly, at a cost for 1 000 copies each month, as follows:

For printing.....		\$2,670 82
illustrating.....		532 25
copyright.....		6 00
Total gross costs for 744 pages.....		\$3,209 07
Deduct for printing and 69 " advertisements.....		661 03
Net cost for..... 675 "		\$2,548 04

or \$3.77 per page.

These 675 pages do not include 18 sheets of plates and 7 "insets" of tabular matter, equivalent to 117 additional pages. In the reports on "Publishing the Papers of the Society" adopted September 17th, and November 5th, 1873,\* the cost of 1 000 copies, 50 pages each month, or 600 pages per annum, was estimated at \$3.75 per page. Plates and "insets" were included in these 600 pages—and the type "was double leaded bourgeois," of which there are but 444 pages in Transactions for the year, the other being "single leaded bourgeois" and "nonpareil," which costs more per page.

"For the year "Transactions" contain 15 papers, covering 340 pages, and discussions covering 150 pages; there are 7 sheets of tabular matter, 15 folding and 4 full page plates, and 47 wood-cuts. The "Proceedings" contain, in addition to the reports mentioned:

\* Page 15.

Announcements of Meetings to be held, Topics discussed, &c.  
Book Notes.

List of Additions to the Library and Museum.

List of Members—Changes and Corrections.

List of new engineering and technological Books.

Notes and Memoranda; Short articles on—  
Catechism of the Locomotive.

Diagrams for computing Earthwork.

First Water Works in the United States.

Gauging of Streams.

Memoir on the construction of a Masonry Dam.

Meteorological Observations at Alleghany Arsenal, July, 1874.

Nomenclature of Masonry.

Tests of Iron and Steel, The Government Commission—Circulars issued, &c.

Tests of Suspension Bridge Cables 32 years old.

Width of Tires of Vehicles.

Proceedings of the Board of Direction and of the Society.

Quarterly Statements of the Finances of the Society.

Speeches at the Dinners of Annual Convention and Annual Meeting.

Vol. III of Transactions closed with the March number, and an Index and Title Page therefor was included in the following number. A table of contents of this and preceding volumes of Transactions is in course of preparation.

A list of Members of the Society, with their addresses, was issued March 30th. The types were kept standing, that corrected editions may henceforth be published at small cost.

Under the rule, authors are entitled to 25 extra copies—when published—of papers submitted by them, and they may order more at cost. The net cost of these for the year is \$76.75. Other publications cost as follows:

Rapid Transit and Terminal Freight Facilities, 1 000 extra copies.....	\$207 00
List of Members.....	70 00
Price List of Transactions, Amendments to Constitution, Norman Medal Rules, &c.	34 42

Referring to the publication of papers in Transactions and to the fact that one octavo plate costs about as much as 20 pages in plain type, and that tabular matter and formulas often are quite expensive to print, the Board suggests for consideration whether By-Law, Section 16, governing publication, should not be so modified that papers have the preference which are most free from tables and formulas and require the least illustrating.

During the past Society year the Library has continued to increase, mostly by the contributions of members and others interested in its growth. There has been added in that time

Books bound—purchased, 16; donated, 161; total.....	177
“ unbound and pamphlets.....	613
Manuscripts (bound volume).....	1
Maps, plans, drawings and charts.....	24
Photographs and engravings.....	76
Models and specimens.....	24

These do not include magazines and papers contributed to the Society by publishers or received in exchange for Transactions as follows:

Annales des Ponts et Chaussées.....	Quarterly,	Paris.
Deutsche Bauzeitung.....	Semi-Weekly,	Berlin.
Engineering News.....	Weekly,	Chicago.
Engineering.....	"	London.
Iron.....	"	"
Journal of the American Iron and Steel Association.....	"	Philadelphia.
Journal of the Society of Arts.....	"	London.
Manufacturer and Iron World.....	"	Pittsburgh.
Monthly Record of Scientific Literature.....	Monthly,	New York.
Nautical Magazine.....	"	London.
Official Gazette of the United States Patent Office.....	Weekly,	Washington.
Railroad Gazette.....	"	New York.
Stummer's Ingenieur.....	"	Vienna.
The American Chemist.....	Monthly,	New York.
Army and Navy Journal.....	Weekly,	"
Builder.....	"	London.
Building News and Engineering Journal.....	"	"
Commissioners of Patents Journal.....	Semi-Weekly,	"
Electrical News and Telegraphic Reporter.....	Weekly,	"
Engineer.....	"	"
Engineering and Mining Journal.....	"	New York.
Iron Age.....	"	"
Journal of the Franklin Institute.....	Monthly,	Philadelphia.
Manufacturer and Builder.....	"	New York.
Railway World.....	Weekly,	Philadelphia.
Telegraphic Journal and Electrical Review.....	Semi-monthly,	London.
Van Nostrand's Eclectic Engineering Magazine.....	"	New York.

Book lists, &c., as follows are subscribed for :

Allgemeine Bibliographie für Deutschland.....	Weekly,	Leipzig.
Bibliographie de la France.....	"	Paris.
Bookseller.....	Monthly,	London.
Publishers' Weekly.....	Weekly,	New York.
United States Official Postal Guide.....	Quarterly,	Boston.

The Society has received in exchange for its Transactions, the official publications, in sets more or less complete, of the following associations :

American Institute of Architects.....	New York.
American Institute of Mining Engineers.....	"
British Patent Office.....	London.
Boston Public Library.....	Boston.
Civil Engineers' Club of the Northwest.....	Chicago.
Department of Agriculture.....	Washington.
Engineers' Club of St. Louis.....	St. Louis.
Essayons' Club, Engineer Corps, U. S. A.....	Willet's Point.
Institution of Civil Engineers.....	London.
Institution of Engineers and Shipbuilders of Scotland.....	Glasgow.
Institution of Mechanical Engineers.....	Birmingham.
Iron and Steel Association.....	London.
Railway Association of America.....	St. Louis.
Revista de Obras Publicas e Minas Publicacao Mensal da Associacao dos Engenheiros civis Portuguezes.....	Lisbon.
Sachsischer Ingenieur und Architecten Vereins.....	Dresden.
Society of Engineers.....	London.
Societe des Ingenieurs Civils.....	Paris.
Zeitschrift des Oesterreichischen Ingenieur und Architecten Vereins.....	Vienna.

Also, at the cost of binding, as the volumes appear :

Certified Copies of Specifications and Drawings of U. S. Patents.....	Washington.
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Including the serials received during the year, and making altogether 40 unbound volumes, the present state of the library is as follows :

Books bound.....	1 854
Books unbound and pamphlets.....	2 878
Manuscripts.....	84
Maps, plans, drawings and charts.....	619
Photographs and engravings.....	357
Models and specimens.....	146

The Board would here call attention to the suggestions in Report for preceding year\*—"Whether a certain specific proportion of the Society's income shou'd not be set apart and appropriated to the increase and maintenance of the Library—to bind in substantial style reports, pamphlets, serials and other works" requiring it; and to purchase standard books of reference.

At the last Annual Meeting, the Board was instructed to provide more commodious quarters for the Society at the expiration of the pending lease, and in compliance therewith, these rooms were leased for two years and have been occupied since May.

From the time they were arranged till the summer vacation, the rooms were open Monday, Wednesday and Friday evenings as well as in the day time. At the July meeting the expediency of keeping them open every week-day evening was considered, and since August the experiment has been tried, excepting on Saturday when the rooms have been closed at 3 o'clock P. M. Reports of Committees on "Change of Rooms"† and on the "Policy of the Society"‡ to be submitted at this meeting, refer to the matter, and it is hoped that measures may be taken which shall make the headquarters of the Society specially attractive to members at the time when generally they have the most leisure.

The Board of Censors to award the Norman Medal, made report at the last Annual Meeting, whereby a paper entitled "Memoirs on the Construction of a Stone Dam," by J. James R. Croes, was declared entitled to the medal, and it was formally presented, February 3d. The Board has ordered that this medal shall be of a mint value of not less than \$60 gold, and the Treasurer was authorized to apply from the general fund of the Society whatever sum in addition to the income from Norman Medal fund should be required.

At a recent meeting of the Board, the President set forth the desirability of a change in the conditions of award of this medal, so that papers read before the Society during the year, as well as those specially prepared for competition, may be eligible for the prize, and he was requested to confer with the donor of the fund, with a view to such change.

Committees at the beginning of the past Society year, charged with the examination of special professional subjects were as follows :§

\* Page 152.    † Page 315.    ‡ Page 316.    § For details concerning the work and composition of these committees, see Report for preceding year, page 153.

On "Tests of American Iron and Steel," appointed June 6th, 1872, W. Sooy Smith, Chairman. This Committee made report at the Annual Meeting, and to promote the objects in view, it was requested to arrange for a meeting of members in Washington during the following session of Congress, which was done; and in consequence of action thus taken, the U. S. Commission to test iron, steel and other metals was constituted. The Committee made report also at the Annual Convention, was continued, and will present another at this meeting.

"On the Form, Weight, Manufacture and Life of Rails," appointed May 22d, 1873, Ashbel Welch, Chairman. This Committee presented a report at the Annual Convention and was continued.

On the "Means of Averting Bridge Accidents," appointed May 22d, 1873, James B. Eads, Chairman. Four reports from members of this Committee were presented at the Annual Convention, and the Committee continued with instructions to report from time to time upon the matter submitted to it.

On a "Plan for the Increase, Maintenance and Preservation of an Engineering Library and Museum," appointed July 2d, 1873, Julius W. Adams, Chairman. This Committee, through its Secretary, made report at the Annual Convention, and was continued.

On a "Comparative Examination of the Principal Pumping Engines in Use," appointed April 1st, 1874, Gorham P. Low, Jr., Chairman. This Committee made report at the Annual Convention, and was discharged.

On the "Founding of a Testing Laboratory for making complete and impartial Tests of the Characteristics, Value and Strength of Materials used in the Arts," appointed April 15th, 1874, O. Chanute, Chairman. This Committee made report of progress at the Annual Meeting, a final report at the Annual Convention, and was discharged.

On "Securing a National Recognition of the Society by Federal Charter or otherwise," appointed June 3d, 1874, Julius W. Adams, Chairman. This Committee made reports at the Annual Meeting and Annual Convention, and was continued.

On "Railway Signals," appointed June 16th, 1874, J. Dutton Steele, Chairman. This Committee made reports at the Annual Meeting and Annual Convention, and was continued.

On "Rapid Transit for Passengers and the Handling of Freight," appointed September 3d, 1874, O. Chanute, Chairman. This Committee made formal report, February 3d, and was discharged.

No committees for similar objects were appointed during this year.

At the meeting April 7th, the following resolutions were made an order of business at the Annual Convention :

I. That a committee be appointed to investigate the feasibility and propriety of organizing the Society—as a whole or by voluntary membership—as a Mutual Benefit Society to aid and benefit the families of deceased members.

II. That a committee of three members of the Society be appointed by the President, to investigate the varieties of nomenclature and classification used in different parts of the



United States to designate the several kinds of stonecutting and masonry and the tools employed in such work and also the corresponding terms used by French, German and English writers on these subjects, and to enquire into the possibility of securing uniformity of practice in such nomenclature and classification.

III. That a committee of three members of the Society be appointed to inquire into the feasibility of establishing a uniform system of gauging of streams and rivers of known watershed, in connection with observations of rainfall and that such committee be empowered to request the co-operation of the Smithsonian Institution and the Franklin Institute in the matter.

The resolutions were separately considered at the Annual Convention, and the first adopted; William E. Worthen, Samuel R. Probasco and J. James R. Croes were appointed the Committee, and will report at this meeting. The other resolutions were again considered September 1st, and it was ordered that the question of appointment of Committees on the Nomenclature of Masonry and on the Gauging of Streams be submitted to the Society to be voted upon by letter ballot—the vote to be closed at this time.

The appointment of committees to report on professional questions has, during the year, received much consideration in the Society. The matter was discussed at the Annual Convention, and a Committee on the Policy of the Society then appointed will report to-day, recommending definite action.

The Society has been called upon several times to nominate from its members, men for certain expert or professional service. Thus the President of the Society, at the request of the President of the United States, named a civil member of the U. S. Commission on the Improvement of the Mouth of the Mississippi; and the Board of Direction at the request of the Secretary of War, nominated several members, from whom the three civil experts of the U. S. Commission to test iron, steel and other metals were selected, and of the Mayor of Providence, a committee who are to examine and report on the system of sewerage in that city. In two instances also requests have come from members, for the appointment of similar committees to investigate and decide mooted questions of practice.

The public standing of the Society may be said to have reached a point that renders anything bearing its impress, of great value in the case of diversity of opinion, or practice arising between engineers, or between them and their clients, or on the part of private or public bodies, in selecting proper persons for specific works. The true policy of the Society forbids any interference, as a body, with the professional practice of its individual members, nor can it with propriety appoint a committee from them to professional duty beyond an examination and report to the association on scientific or professional questions of general interest, wholly removed from immediate application to a specific local purpose; yet one of the benefits to be anticipated from the formation of the Society, and the one which commends itself most to the public, would be lost, if it declined to entertain in any way such applications for professional aid. While at the request of public or private bodies a

committee cannot be appointed by the Society for the performance of local professional duties, it is entirely in accordance with its policy, that authority should exist *somewhere* in the Society, for the nomination of proper individuals to perform required duty, upon application from respectable bodies seeking for professional qualifications of a certain order, and this without the delay inseparable from the method of appointing committees by letter ballot. It is therefore suggested that applications for special professional aid be referred to the President, who shall nominate those of the members whom he shall consider suited to the duties required; such nomination to be referred to the Board of Direction for its action, which, with the question whether such application be received, shall then be considered, and the determination of the whole matter shall rest with the President and Board of Direction.

At the last Annual Meeting the fees of Fellows subsequently admitted to the Society was reduced from \$250 to \$150, and to-day the Society will be asked, on recommendation of the Board, October 3d, to increase the fee of resident Juniors from \$10 to \$15.

At the same time, on recommendation of Committee of the Board on a Revised Constitution of the Society, Section 23 of the By-Laws, wherein are recited requirements for the several classes of members, was amended, so as to more distinctively establish the qualifications for each class.

The Board earnestly requests attention of members to this portion of the preceding report—referring to proposal of candidates.\*:—

The "qualifications of admitted members are defined by the Constitution and By-Laws; the applicant must affirm in detail that he, by length and quality of service, possesses them; two members of the Society must certify to his statement, and that they, from personal knowledge, believe him to be in all respects a proper person to be admitted to the Society; the Secretary, Committee on Admissions and Board of Direction examine the application, and the latter determines if it entirely conforms to the requirements. A ballot is then sent to each member, who can vote *aye* or *nay* as in his judgment, what he personally knows of the fitness of the candidate may be favorable or not, and *three* negative votes prevent an election."

"There is consequently no good reason why an ineligible, incompetent or unworthy person should be admitted; the influence and dignity of the Society, as well as the integrity of the profession it seeks to elevate and conserve, demand that in official or personal capacity, each member shall conscientiously discharge his duty in this matter. It is to be understood that the Board of Direction passes on the personal qualification of members, solely under the requirements of the Constitution and By-Laws:—the election of such rests with the individual members by their ballots."

But two changes in the organic law of the Society have been regularly proposed during the year, both being additions to the By-Laws. The first was presented at the meeting February 3d, when the Report on Rapid Transit was under consideration, was duly seconded and referred to the Board of Direction; it is—

Section 31. No Special Committee shall be appointed except on written notice given at a previous regular meeting of the Society.

The second proposed at the Annual Convention and referring to Conventions, has already been mentioned.

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\* Page 158.

The general report of the Treasurer of the Society, on the state of its finances for the year ending this day, is appended.

During the year the Society has been called upon to mourn the loss of :—

Eddy D. Mason, C. E., admitted as Member July 19th, 1872; became Fellow, December 28th, 1872, who died December 19th, 1874.

William L. Dearborn, C. E., admitted as Member January 29th, 1868, who died March 15th, 1875.

James Laurie, C. E., first Member and President of the Society; admitted November 9th, 1852, who died March 15th, 1875.

Isaac D. Colman, C. E., admitted as Member February 27th, 1869, who died April 8th, 1875.

T. Willis Pratt, C. E., a member from November 2d, 1853, until the reorganization of the Society, and one of the second Board of Direction; who became Fellow, November 4th, 1870, and died July 17th, 1875.

Henry M. Gardner, C. E., admitted as Member December 1st, 1852, who died July 26th, 1875.

Edward H. Tracy, C. E., admitted as Member June 13th, 1868, who died August 28th, 1875.

Ira Spalding, C. E., admitted as Member August 2d, 1870, who died October 2d, 1875.

Memoirs of the deceased are appended.

Respectfully submitted,

G. LEVERICH, *Secretary.*

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## REPORTS OF COMMITTEES.

### ON TESTS OF AMERICAN IRON AND STEEL.

ADOPTED NOVEMBER 3d, 1875.

The Chairman of Committee on Tests of American Iron and Steel, begs leave to submit the following report:

As already made known to the Society,\* the Board appointed by the U. S. Government to make a complete set of tests of iron, steel and other metals has been fully organized, and its labors projected and entrusted to special committees. These committees have issued circulars which have reached members of the Society through Transactions.† The committees which are charged with labors that can be performed wholly or in part without the use of the testing machine contracted for

by the Board, have begun their work, and some of them already reached valuable results.

The Board desires to be the medium through which the best ability of our country may work out that complete and accurate knowledge of the useful metals which is deemed so valuable; and to this end it has, through the circulars referred to, asked engineers to aid by suggesting the kinds of tests considered most valuable and the best methods of making them. It has also requested the same kind of assistance from those engaged in the manufacture and use of the metals. In this way, a lively interest in the work of the Board is beginning to be developed throughout the country, as evinced by the replies to the circulars already received.

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\* See Report presented May 3d, 1875, page 222. † Pages 270, 284 and 295.

This Committee again bespeaks for the Board the earnest and continued co-operation of members of the Society, in order that the work undertaken may be so thoroughly and completely done, that the final report of the Board may become the worthy *vade mecum* of every engineer, architect, metal maker and metal worker in the land.

It would also remind members that the appropriation, \$75 000, to be expended by the Board, and mostly required for the necessary testing apparatus, is only sufficient—as explained to Congress—to make a fair beginning of the work. Additional appropriations will be required, and the Society can aid greatly in

procuring them. While such is the special work of this Committee, its labors will be lightened and its success rendered more certain by the explanations which members can give to Congressmen of their acquaintance, of the character of the work to be performed by the Board, and its value to the country; for it is believed that an intelligent understanding of the object proposed is all that is needed to commend it to the hearty approval and support of every member of Congress.

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Respectfully submitted,

WILLIAM SOOY SMITH,  
Chairman.

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## ON A CHANGE OF ROOMS OF THE SOCIETY.

ACCEPTED NOVEMBER 3D, 1875.

The Committee appointed with reference to a change in the rooms of the Society, has to report:

That after informal consultation with members of several societies, the object and necessities of which might render concert of action desirable, a formal conference was held, at which five societies were represented; the result of which was to the effect that decided advantages, both in comfort and economy, might be secured in the combined occupation of a suitable building by two, three, or even a larger number of kindred societies.

None of the societies represented were ready at that time to take positive mutual action. It was decided to recommend that the officers of the societies, or the commit-

tees charged with the duty, be requested to keep the matter in view and to continue the consideration of suitable arrangements for the future.

The present rooms of the Society were rented for two years only, after rather exhaustive examination both by the Committee and the Board of Directors.

That the full value of their accommodations may be attained, the Committee suggest that measures be taken to invite the co-operation of all members of the Society, in their fuller use.

Respectfully submitted,

JOHN BOGART, W. MILNOR ROBERTS,  
F. COLLINGWOOD,  
Committee.

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## ON TIME AND PLACE OF THE EIGHTH ANNUAL CONVENTION.

ACCEPTED NOVEMBER 3D, 1875.

The Committee on Time and Place of the Eighth Annual Convention have to report, that replies to circulars sent out were received from 121 members.

Of these, as to time 55 name June, 13 July, 6 August, 5 May, 3 September, 2 October, 1 March, and 36 express no choice; and as to place, 57 name Philadelphia, 20 Boston, 6 Washington, 5 New York, 3 Baltimore, 2 St. Louis, 1 Cleveland, 1 Niagara Falls, 1 Providence, and 25 express no choice.

Although there is not a majority of the votes in favor of either time or place above named, in deference to the wishes of many members—as set forth in their replies—to attend the Centennial Exposition, the Committee would recommend that the Eighth Annual Convention be held in Philadelphia, June 13th, 14th and 15th, 1876.

Respectfully submitted,

G. LEVERICH,  
Chairman.

## ON THE ORGANIZATION OF A MUTUAL BENEFIT SOCIETY.

ACCEPTED NOVEMBER 3D, 1875.

The Committee appointed under the resolution of June 10th, 1875, to "investigate the feasibility and propriety of organizing the Society as a whole, or by voluntary membership, as a Mutual Benefit Society, to aid and benefit the families of deceased members," bega leave to report as follows:

The great majority of civil engineers depend solely upon their professional income for support, and find that this income is barely sufficient to meet their current expenses. In case of the death of an engineer, it is believed to be rarely the case that his family have the means to meet with ease the extraordinary expenses attending his death and funeral. An association of members of the profession, for the purpose of aiding in the payment of such expenses at the time when such relief is greatly needed, appears to be desirable.

It is not advisable that the Society as a body should be committed to any project of this kind, but it does seem expedient that a simple voluntary organization should be formed within the Society and confined to its members, having for its object the immediate relief of the families of such members of the organization as may die.

Similar voluntary organizations exist in associations of other professions and callings, and have been found to be of great benefit. The general principles on which such of these organizations as have been successful are based are:—*First*: Membership is restricted to a certain professional class. *Second*: An entrance fee is required, a specified proportion of which is applied to the payment of necessary incidental expenses, and *Third*: On the death of any member, each of the surviving members pays a fixed sum, the whole of which is sent at once to the family of the deceased.

Among the organizations, the rules of which have been examined by the Committee, are the following:

New York Board of Brokers,—Number of members 1060. On death of a member, each surviving member pays \$10. Of the \$10 600 thus obtained, \$10 000 is paid to the heirs of the deceased, and the balance goes into a sinking fund, the interest of which is at times divided among members. Average yearly deaths, 12.

The Police Mutual Benefit Society of N. Y. City; organized August, 1871. Number of members in 1874, 141. Deaths from organization to March 1, 1874, 7. Entrance fee \$5. Death fee \$5. No persons are admitted over 50 years of age.

The Clergymen's Mutual Insurance League; limited to clergymen of the Protestant Episcopal Church; organized September, 1868. Entrance fee \$2. Death fee \$2.

Members.....	1st year,	370.....	Deaths, 1
"	.....2d	" 666.....	" 5
"	.....3d	" 835.....	" 6
"	.....4th	" 996.....	" 11
"	.....5th	" 1 029.....	" 13
"	.....6th	" 1 052.....	" 19
"	.....7th	" 1 049.....	" 18

To compare the death rate of the above associations with that of the American Society of Civil Engineers, we give the following:

Average no. members	1872,	250.	Deaths, 2
" " "	1873,	315.	" 3
" " "	1874,	361.	" 5
" " "	1875,	403.	" 8

The Committee recommends that a voluntary organization be formed within the Society, on the following basis:

1. The organization shall be styled the Civil Engineers' Insurance League. Its place of business shall be at the rooms of the American Society of Civil Engineers, in the city of New York.

2. No persons shall be admitted as members, except Members and Juniors of the American Society of Civil Engineers.

3. The officers of the League shall be a President, a vice-President and three Directors, who shall choose a Secretary and Treasurer from among their own number. The officers shall be "Resident Members" of the American Society of Civil Engineers, and shall be elected annually on the first Wednesday of November, by a plurality vote of the members of the League present.

4. A statement of the business condition of the League shall be made by the officers on the first of November and first of May in each year.

5. There shall be an entrance fee paid by every person who may become a member. This shall be \$5 for persons under 45 years of age, and \$10 for persons over 45 years of age.

6. On receiving proof of the death of any member, the Secretary shall at once issue by mail a notification of such death to each member. The members so notified shall thereupon pay to the Treasurer the sum of \$5. In default of such payment within 60 days after date of the sending of the notification by the Secretary, the person so defaulting shall forfeit membership in the League and his name shall be stricken from the roll.

7. Upon receiving proof of the death of a member, the Treasurer shall within 3 days thereafter transmit to the heirs or assigns of the deceased the sum of \$500, and within 60 days thereafter the additional amount required to make the total sum equal to \$5 for each member of the League who has responded to the assessment.

The Committee is of the opinion that the organization of such an association should not be made until 100 persons have signed

their intention of joining the same, and to test the feasibility of forming such a League, recommend the passage of the following resolution: \*

Resolved: That the Secretary be directed to forward to each Member and Junior of the Society a copy of this report, and request a reply in this form, viz.:

I . . . . . a (*Member or Junior*) of the American Society of Civil Engineers, . . . . . become a member of a Civil Engineers' Insurance League, formed on the basis recommended in the report of the Committee presented November 3d, 1875.

Respectfully submitted,

W. E. WORTHEN, S. R. PROBASCO,

J. J. R. CROER,

Committee.

\* The resolution was adopted, and in compliance therewith a circular will be issued December 2.

## ON THE POLICY OF THE SOCIETY.

ACCEPTED NOVEMBER 3D, 1875.

The Committee on the Policy of the Society begs leave to report as follows:

The "Policy of the Society," the Committee understands to be such a system of measures and management as shall best promote the objects for which the Society was founded.

These objects are:—"The professional improvement of its members, the encouragement of social intercourse among men of practical science, the advancement of engineering in its several branches, and the establishment of a central point of reference and union for its members."\*

In general terms, the most obvious methods of promoting these objects are:

*First.* The subjective method, or increasing the effect of the Society upon itself—making it more directly instructive and useful to its members. Its chief means for doing so are, bringing its members into contact with each other at its various meetings and reunions; its papers and discussions, its system of collecting information, and its publications. If there were no meetings—if the technical work of the Society were done by publications alone, it would undoubtedly die out. The history of such organizations seems to prove that they flourish in proportion to the frequency of the meetings and the attendance upon them. The personal contract of pro-

fessional men whose names and works are known to each other, stimulates their desire to meet again, and to dispute or agree again, as the case may be, and to meet other professional men under similar circumstances; and so gives vitality to any organization which will promote such meetings. There is nothing contagious in the discussion of technical problems by means of newspapers and pamphlets.

It should appear, then, that the meeting underlies all the other means, and that our first and best efforts should look towards the gathering of more engineers, at more frequent intervals—not so much as an end—but as a means of stimulating contributions to the professional and physical welfare of the Society, and interchange of views, both in private conference and in public discussion.

*Second.* There is the objective method, or increasing the influence of the Society upon the public. As the Society becomes more and more known for the high professional standing of its members, for the extent and value of their works, and for the excellence of their technical papers and discussions, other engineers will be more anxious to join it; raising its standard of qualification for membership will become easier, the public will be more desirous of intrusting works to

\* Constitution, Article II.



its members, and it will give character to those who belong to it, and credit to those who contribute to its physical resources, to its library, to its means of gathering and observing professional works in different parts of the country, and perhaps, one day, to a worthy edifice which shall be its home. The reflex action of these external influences will be of personal advantage to the members, and both the Society and the public will be benefited.

The influence of the Society upon the public is unfortunately not very rapidly developed by the mere professional character of its members, although this is the ultimate basis of its influence and usefulness. There must be some connecting links between the Society and the public. The printed Transactions attract the attention of professional men, and form one such link, but the meetings, more especially the Conventions of the Society, bring it into contact not only with professional men, but with commercial men who are interested in the industrial works and internal improvements of the country.

Another means of enlarging the power of the Society, both within and without, is the work of special committees. While the investigations of such committees upon subjects of professional interest and often of vast importance to large communities, will usually embody information of great value to members and to the public at large, it has become evident that the welfare and usefulness of the Society, as such, may be impaired, not by the collection of facts nor by the making of generalizations, but by the putting forth in the name of the Society, of individual opinions upon specific plans which are likely to become subjects of professional competition among members. It being obviously impossible to lay down a general rule which shall meet all such cases, it seems eminently proper that the Society at large should pass upon the subjects of special reports. Bad work may be commented upon, wherever found, but there are as many subjects as such committees can be found to investigate, which do not present embarrassing features.

Another means of promoting the welfare of the Society in both the directions specified, is to make it more valuable to non-resident members. They can rarely be present at regular meetings, and thus have little voice in the discussions or in the management. The interest of non-residents in the Society may be stimulated in various ways:

1st. By choosing more officers from that class, enough being residents of New York to transact ordinary business.

2d. By keeping open and making attractive the Society's rooms. Many non-residents visit New York frequently, and would undoubtedly be glad of this opportunity to meet other members, to consult the professional literature and to enjoy such hospitalities as could under these circumstances be easily extended.

3d. By making the most of the Annual Conventions. This chiefly lies with the individual members; if they will more generally attend, they will by that means build up the interests of the Society, by bringing its good things to the non-residents in turn, and by increasing membership, more than by almost any other means requiring the same effort.

These considerations influenced the Committee in making the following report to the Convention at Pittsburgh.\*

"The Committee appointed to report upon the matters contained in Mr. Boller's paper proposes no further changes in the By-Laws, but it respectfully suggests to this Convention the formation of a more permanent committee, to take into mature consideration all changes in the By-Laws and Constitution."

"The Committee desires to make the following suggestions, in regard to the policy which should govern such changes."

"The subject which appeared to require the most immediate attention—the formation of special committees to report on engineering subjects—is, perhaps, sufficiently provided for in the resolution adopted by the Convention,† that such Committee shall be formed by a majority of the votes of the Society, either in Convention or Annual Meeting, or by letter ballot. The Committee purposely avoided recommending that any limitations be imposed on such special committees, believing that the proposed method of appointing them, and the lately awakened attention of members to the importance of limiting *themselves* in these matters, will, for the present at least, fully meet all the requirements. It also seems impracticable to make general limitations to cover special cases."

"While admitting the importance of revision of the laws governing the Society, and of some additions to them, the Committee cannot refrain from expressing a belief, that the danger in associations like this, as well as in civil affairs, is that there be too much government and too many laws, rather than the contrary. It is undoubtedly better to postpone legislation until evils become so imminent as to unmistakably threaten danger, than to attempt to provide for contingencies which do not yet exist."

"The resolution proposed by Mr. Shinn, regarding Annual Conventions, and referred to this Committee, is recommended for adoption by this Convention."

"The Committee recommends that the Library Committee consider the abandonment of the copyright system."

"The Committee is of the opinion that social meetings similar to the *Conversations* of the Institution of Civil Engineers, would contribute to the interests of the Society, but recommend that, for the present, such meet-

\* Page 261.

† Page 251.

ings be arranged and conducted at the expense of those members who are willing to inaugurate the system."

"It is further suggested, that whenever new or doubtful questions arise affecting the policy of the Society, the Board of Direction shall—by circular and reply, in manner similar to the letter-ballot—refer the same to the membership for an expression of opinion."

"By an unwritten law of the Society, the officers have heretofore been selected from the resident class; it is suggested that so long as enough members of the Board of Direction, to transact business, reside near New York, other officers may be chosen as representative men without reference to their location."

As this report seemed to generally meet the views of the members present at the Convention, the Committee is encouraged to believe that the following resolution, based on the foregoing consideration, will be approved by the Society:

*Resolved*, That the following be recommended to the Society as additions to the By-Laws:

Section——. Special committees to report on engineering subjects shall only be authorized by a majority of the votes cast by the Society, either in Annual Convention, at the Annual Meeting, or by letter-ballot. If by letter-ballot, a resolution proposing the formation of any such special committee shall be referred to the Board of Direction, which shall examine the same and report to the Society, such report to be embodied in the said letter ballot. If the Board does not report within one month, the ballot shall be issued without comment.

Addition to Section I. A Convention of the Society for professional discussion and social intercourse, shall be held annually, at such point as the Society may determine, and be presided over by a chairman selected from among Members not officers of the Society; during the Convention, a business meeting shall be held, when the business of the Society may be transacted; said meeting to be held as a regular meeting of the Society.

Section——. The Ex-Presidents of the Society shall be Honorary Members with the right to vote, and shall be *ex-officio* members of the Board of Direction.

Section——. The officers of the Society shall give a reception at the Society's rooms on the evening of the—— of each month between November 1st and April 1st, for the purpose of informal professional conversation and social intercourse. Refreshments may

be provided by those participating, and each member may invite a guest.

Respectfully submitted,

A. L. HOLLYAY, THEO. G. ELLIS,

T. C. CLARKE,  
Committee.

#### DISCUSSION.

J. JAMES R. CROES submitted the following to the Committee, which was read at the Annual Meeting, and with the report, referred to the Board of Direction:

1°. Concerning Special Committees.—When a letter-ballot is sent out to determine whether a special committee shall be appointed to report on engineering subjects, it should be accompanied with a concise statement of argument for and against appointment of the proposed committee.

2°. Concerning Past-Presidents.—Instead of making Past-Presidents *Honorary Members*, would it not be better to make them *Life Members and Directors*. An honorary member of an organization is never an active member, and is always supposed to be a person of great eminence. A President of the Society may be elected who would not be acknowledged as standing high enough, to be elected unanimously to honorary membership. The effect of the classification proposed by the Committee would be to lower the qualifications for honorary membership and create an anomalous position—that of an Honorary Member who was one of the most active members.

3°. Concerning Conventions.—Why should a full set of officers be elected to attend to the business of the Society and preside at 24 business meetings, and then all of them be thrown over for a 25th extra business meeting, and a person chosen to preside who, not familiar with the action of the Board of Direction and the business in hand for the rest of the year. It seems to me the most unwise thing that could possibly be done, to debar the regular officers of the Society from presiding at one the largest meetings in the year, and one at which a great many members are apt to be present who never attend other meetings.

If there is a desire on the part of many members to incorporate such a provision in the By-Laws, it should be separated from that defining the status of conventions, so that those who are opposed to the provision, but in favor of conventions, may have an opportunity to vote for the latter, but against the former.

## NOTES AND MEMORANDA.

PRESENTED NOVEMBER 3D, 1875.

AMERICAN ENGINEERING AT THE CENTENNIAL.—The following extracts from correspondence with the Secretary were read at the Annual Meeting:

WILLIAM SOOY SMITH wrote, September 8th: I think we should have space allotted to us for the exhibition of engineering plans, devices, models and machinery, such as would best illustrate the progress and status of civil engineering in the United States. The sense of the Society regarding the matter should be obtained.

HENRY PETTIT (Chief of Bureau of Installation) wrote, October 15th: I will give such points as will enable the Society to represent American engineering at the Centennial in a creditable manner if it should be decided to undertake to do so.

The accompanying copy of the classification shows that the principal part of the exhibit of the American Society of Civil Engineers would be under classes 330 to 385 inclusive, and be located in the main building—railroad stock, machines, &c., will be shown in the Machinery Hall. Additional space south of the Main Building will be granted in the grounds, if any exhibit presented should be suitable for such a location.

Personally, I am particularly desirous of having at least one branch of our profession, viz., metallic bridge construction, well represented, as I have reason to know by experience that much of such American work will be novel, instructive, and entertaining to foreign engineers visiting us. The very few illustrations of bridge work which, I myself, exhibited at Vienna, were noticed and apparently appreciated by the Austrian Engineers and Architects' Association far more cordially than I had any right to expect. I feel confident that a characteristic and attractive display in this and other branches may be made at the Centennial, by an effort on the part of members of our profession, acting through the Society as their representative. A collective exhibit made in that way will insure a creditable representation of American engineering, much more effective than by independent individual effort. It must be distinctly understood, however, that all who prefer to make application for space inde-

pendently of the Society would be at liberty to do so.

I would prefer models and finished drawings to any other method of exhibiting, would not limit as to scale for models, but keep them characteristically American, and as small in bulk as possible. Quality not quantity, no duplicates, &c., &c.

JAMES H. HARLOW wrote, October 19th: I would offer the following: Resolved, that a committee of seven be appointed by the American Society of Civil Engineers to secure rooms in Philadelphia, and make such other arrangements for the entertainment of visiting foreign engineers as may be desirable during the Exposition to be held in 1876.

Resolved, that the Treasurer of the Society shall be a member of said committee.

Resolved, that the Treasurer be directed to pay to the above committee such a sum as may be necessary to pay expenses, not exceeding \$.....

The reason for the above is, that there will be a large number of engineers from kindred societies present at the Exposition, and it may be a convenience for them to have some place where they can make their headquarters, receive mail, make appointments, &c.; it will also enable engineers to get acquainted, and possibly to learn something.

WILLIAM SOOY SMITH wrote, October 22d: Referring to my suggestion that the Society put in an appearance with the other learned societies of our country at the Centennial, I would say, that the following is, in a general way, the character of the display, I think, we should make and the manner of preparing it.

1st.—There should be an exhibition of designs of structures erected, and these can be best shown by means of drawings and models. Of course, it is easier to represent some descriptions of work in this way than others; but even harbor improvements, to which allusion has been made, can be tolerably well shown by properly prepared drawings and models. One of the most extensive works of this class on the Lakes was very handsomely represented by a model in the recent Exposition in Chicago. Bridge construction can be very satisfactorily illustrated in this way—as

we all know—both substructures and superstructures. The same is true of almost every description of railroad work. And, I think, this department of our exhibition could, with the hearty aid of our older members—the fathers of our profession in this country—be made historical. The various kinds of permanent way, the different plans of bridges, both wooden and iron, and the many contrivances of every kind that have been invented and used by the men of our profession in railroad construction and management in this country during the last hundred years—if fitly shown by drawings and models—would be, perhaps, as useful and attractive an example of "object teaching" as the Centennial will afford. Our older engineers should also give us a chance to glance over that bright page in the history of our profession in this country which was illustrated by the construction of our great canals.

Without going more into detail in this branch of the subject, the above is, perhaps, enough to call forth from other members—better capable of treating it than I am—such suggestions as will perfect a plan of doing this thing which shall fitly exhibit the progress made in the department of construction by American civil engineers during the first hundred years of our existence as a nation.

2d.—The machinery employed by American engineers in the construction of their works should be shown by drawings and models—the latter being on working plans whenever practicable. Pile drivers, dredges, engines and pumps, hoisting machines, and all kinds of hydraulic and pneumatic machinery can be thus shown. I believe that we excel most nations in this department of engineering, and I feel anxious that this excellence should be made to appear.

If ground room can be afforded us, some of us might even exhibit the machines themselves in operation.

To get together such a collection of drawings, models and machines as would be creditable to us, we would need, first, the earnest co-operation of all the members of our Society; and second, the assistance of the railway companies and of such manufacturing companies as are engaged in the production of the work we require—such as bridge-building firms, engine makers, etc.

CLEMENS HERSCHEL wrote, November 2d: Enclosed please find a document to read at the Annual Meeting. The Boston Society of Civil Engineers has had the subject before it; the tone of the meeting seemed to be decidedly favorable, a committee was appointed

to report back to the Society, and action will, presumably, be taken at the next meeting.

**METRICAL SYSTEM OF WEIGHTS AND MEASURES.**—The members of the American Society of Civil Engineers are, doubtless, aware of the immense advantages, in all matters involving the least computation, of a system of weights and measures conforming to the decimal arithmetic which is universally established.

This is shown by the use among railroad engineers, land surveyors and others of the decimals of the foot, in spite of its being contrary to the usage of the rest of the community, and for aught the writer knows, contrary to law. Neither do the members need to be told of the superiority of a simple system, with its units mutually related, over irregular standards not naturally associated with one another, and ambiguously named. The need of uniform standards among all civilized nations is also sufficiently evident now that modern inventions have led to such an enormous increase of intercourse; while the units now in common use in this country differ materially even from those of Great Britain.

It may not, however, be so generally known that the present moment offers a favorable opportunity for securing the advantages referred to, by deciding upon the adoption of the metric system. This has been used by the scientific world for many years, and was made legal by the United States Government in 1866. The architects, apothecaries, physicians and others in the community are agitating the general use of the new measures, and there appears to be a wide-spread feeling among the people of readiness to make the needful preparations for gradually abandoning the old units, *if only they could be sure of general support in the reform.* Hence it would seem that the time has arrived for Congress to pass the additional laws for which we have had nine years' preparation, and it is therefore, proposed that the American Society of Civil Engineers petitions Congress to fix a date, say three years hence, after which the metric system of weights and measures shall be the only legalized standard. To this end, I would move that the question of whether so to petition Congress shall be voted on by the Society by letter ballot. Documents bearing on the whole question have been printed by the American Metrological Society, an association whose object it is to introduce the metric system in this country, and an effort will be made to procure and place with the Secretary for distribution to all the members, copies of such papers.

## NEW BOOKS ON

## ENGINEERING AND TECHNOLOGY.

Under this head will be announced new books on these and kindred subjects published in English, French and German, which may be professionally useful to members of the Society.

At the present rates of duty and exchange, the cost of imported books may be estimated in federal money, at one shilling, equal to 35 cents.

- Air-Meters, Account of Experiments made comparing indications of 2 Cassella's Air-Meters. Charles B. Richards. Philadelphia. 8vo. *Franklin Institute*.
- Alphabet, Origin of our Alphabet. J. Ent-hoffer, New York. 8vo, illus. *Westermann*. \$0.50.
- Architecture. Notes on Irish—Lord Dun-raven, ed. by Stokes. 2 vols. London. 4to, illus. *Tell & Sons*. Vol. I. 84s.
- Arithmetic, Instrumental, a Treatise on—  
—or the Utility of the Slide Rule, designed  
as a Pocket Companion, &c, with full and  
complete Instructions for every Mechauc  
and Operative to make his own Calculations  
Hartford, 16mo. *Bicknell (New York)* \$1.00.
- Art. Principles of Ornamental— F. Ed-  
ward Hulme. London. 4to, illus. *Cas-  
sel, Pöller & Galpin*. 25s.
- Autobiography of Sir John Rennie, Past  
President of the Institution of Civil En-  
gineers, ed. by C. G. C. Rennie. London.  
8vo, portrait. *Spons (New York)*. \$5.00.
- Band Gearing, E. J. Cowling Welch. Lon-  
don. Folio *Spons (New York)*. (Announce-  
ment)
- Boiler-Makers and Iron Shipbuilders' Com-  
panion. New ed., James Foden. London.  
12mo. *Spons (New York)*. 6s.
- Bridge and Tunnel Centres. John B. Mc-  
Master. New York, 16mo. \$0.20.
- Canals, Annual Report of the State Engineer  
and Surveyor on the Canals of State of New  
York, for year ending Sept. 30, 1874. Al-  
bany. 8vo. Maps.
- Carpentry, elementary Principles of—  
Thomas Tredgold, rev'd from the original  
ed., and partly re-written by John Thomas  
Hurst, 2d ed. London. 8vo, illus. *Spons  
(New York)*. 18s.
- Charcoal Burners, Handbook for— G.  
Svedelius, transl. from the Swedish by R.  
B. Anderson; ed. with Notes, by W. J. L.  
Nicodemus. New York. 12mo, illus.  
*Wiley*. \$1.50.
- Chemistry, inorganic and organic—with Ex-  
periments. 3d ed. Charles L. Bloxam,  
London. 8vo, illus. *Churchill*. 16s.
- inorganic Chemistry for elementary  
Classes. 7th ed. W. A. Snaith and A.  
Gardner. 12mo, illus. *Simpkin*. 4s. 6d.
- Manual of introductory chemical  
Practice, for the Use of Students in Col-  
leges and normal and high Schools. George  
C. Caldwell and A. A. Breuneman. Ithaca.  
8vo, illus. *Finch & Apyar*. \$1.50.
- theoretical, practical, and analytical, as  
applied to the Arts and Manufactures.  
Philadelphia, illus. *Lippincott*. (Announce-  
ment.)
- Climate of the Earth, past and present, Notes  
on ——— Capt. R. A. Sargeant, Roy. Eng.  
London, 8vo. illus. *Smith, Elder & Co.*  
4s.
- Coach-Maker's illustrated Hand-Book, con-  
taining complete Instructions in all the  
different Branches of Carriage Building.  
2d ed. Philadelphia. 8vo, illus. (*Van  
Nostrand, New York*.) \$3.00.
- Cyclopædia, American—a popular Dictionary  
of general knowledge. George Ripley and  
Charles A. Dana, Editors. Vol. XIII. Pale-  
stine to Printing. New York. 8vo, illus.  
*Appletons*. \$5.50.
- Differentials of Functions, a new method of  
Obtaining—with especial reference to the  
Newtonian Conception of Rates or Veloc-  
ities. J. Minot Rice and W. Woolsey John-  
son, new ed. rev. New York. 12mo. *Van  
Nostrand*. \$0.50.
- Drawing, Hand-book of Foliage and Fore-  
ground—3d ed. George Barnard. London.  
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- Electro-Metallurgy, Manual of—containing  
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Gold, Copper and other Metals. 5th ed.,  
rev. and enl. James Napier. London.  
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nouncement.)
- Engineering. Syllabus of the Lectures on—  
at Owen College by Prof. Osborne Rey-  
nolds, with a series of Examples by J. B.  
Millar. London. 8vo. *Spons (New York)*.  
\$1.50.
- Engineers' and Mechanics' Tables, containing  
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Strength of Materials, Limes, Mortars and  
Cements. P. Munzinger Philadelphia.  
8vo, illus. (*Van Nostrand, New York*.)  
\$5.00.
- Engineers and Shipbuilders in Scotland:  
Transactions of the Institution of— Vol.  
XVIII, 8th Session, 1874-5. Glasgow. 8vo,  
illus.
- Ether, Physics of—T. Preston. London.  
8vo. *Spons (New York)* \$3.00. (Announce-  
ment)
- Expedition, Report of—up the Yellowstone  
River in 1875, by Col's J. W. Forsyth and  
F. D. Graut. War Department, Washing-  
ton. 8vo. Maps.
- Explorations, preliminary Report of—in  
Nebraska and Dakota in 1855, '56 and '57,  
by Gen. G. K. Warren. (Reprint.) En-  
gineer Department, Washington. 8vo,  
Maps.
- Explosives, Researches on—Fired Gun; ow-  
der. Capt. Noble and F. A. Able. London.  
4to. (*Van Nostrand, New York*.) \$5.50.



- Fortification, Hand-book of Field—intended for the Guidance of Officers preparing for Promotion, and especially adapted to the Requirements of Beginners. Maj. W. W. Knollys. London. 12mo, illus. *Lockwood & Co.* (Announcement.)
- Geology, first Book of—Ed. S. Morse. New York. 12mo, illus. *Van Nostrand*. \$1.25.
- Geometry, practical—and Engineering Drawing. Geo. Sydenham Clarke. London. 4to, illus. *Van Nostrand (New York)*. \$7.50.
- Selected Propositions in geometrical Constructions and Applications of Algebra to Geometry, being a Key to the Appendix of Davies' Legendre. New York. 12mo. *Barnes*. \$1.00.
- Hygiene and Public Health, Dictionary of—comprising sanitary Chemistry. Engineering, and Legislation; the dietetic Value of Foods, and the Detection of Adulterations. Alexander Wynter Blyth. On the plan of the "Dictionnaire d'Hygiene Publique" of Prof. Ambrose Tardieu. London. 8vo, illus. *Charles Griffin & Co.* (Announcement.)
- Iron and Steel. Statistical Report of the Secretary of the American Iron and Steel Institute in Detail, to January, 1875. Philadelphia.
- Lace, History of—3d ed. with Additions. Mrs. Bury Palliser. London. 8vo, illus. *Sampson, Low & Co.* 21s.
- Life on our Planet, Origin and History of— an Address by Vice-President J. W. Dawson, before the American Association for the Advancement of Science, at Detroit, Mich., August, 1875. New York. 8vo. \$0.20.
- Light as a Motive Power, a series of Meteorological Essays. R. H. Armit. Vol. 1. London. 8vo, illus. (*Van Nostrand, New York*.) \$7.50.
- Light, the revised Theory of—Section I.: the Principles of the Harmony of Color. W. Cave Thomas. London. *Smith, Elder & Co.* (Announcement.)
- Magnetism and Electricity. John Cook. London. 12mo. *Van Nostrand (New York)*. \$0.50.
- Mechanical Engineer, his Preparation and his Work, an Address to the graduating Class of the Stevens Institute of Technology. R. H. Thurston. New York. 8vo. *Van Nostrand*. \$0.50.
- Engineers; Proceedings of the Institution of—June and July, 1875, Nos. 3 and 4. Birmingham. 8vo, illus.
- Mechanics' and Builders' Time-book for the Pocket. Containing a Calendar for 1876-7, Wages Table, for 51 and 54 Hours; with other useful Tables and Information. Calvert's. London. *Simpkin, Marshall & Co.* 6d.
- Monuments, Records of the Past; being English Translations of the Assyrian and Egyptian Monuments. Vol. 5. Assyrian Texts. London. 8vo. *Bagster*. 3s. 6d.
- Naval Experimental Battery at Annapolis, Maryland, Objects and Resources of— (A report to the Bureau of Ordnance U. S. N.) Washington. 8vo, illus.
- Oars and Sculls, and how to use Them. Walter Bradford Woodgate. London. 8vo. *George Bell & Sons.* (Announcement.)
- Painting, practical Manual of House—Graining, Marbling and Sign Writing, with Plates of Woods and Marbles printed in Colors. Ellis A. Davidson. London. 12mo, illus. (Weale's series.) *Lockwood & Co.* 6s.
- Paper-making Material, Bamboo considered as— with Remarks upon its Cultivation and Treatment. Supplemented by a Consideration of the present Position of the Paper Trade in Relation to the Supply of raw Material. Thomas Rutledge. Printed on Paper made by the Author from Bamboo. London. 8vo. *Spons (New York)*. \$0.80.
- Patents, Specifications and Drawings of— issued from the U. S. Patent Office, Apr. 1, May and June, 1875. 3 Vols. Washington. 8vo, illus.
- Physics, elementary Treatise on—translated by E. Atkinson. 7th ed, rev'd and enl'd. London. 8vo, illus. *Longmans*. 15s.
- Plants, Catalogue of—growing without Cultivation within 730 Miles of Amherst College. Edward Tuckerman and Charles C. Frost. Amherst. 12mo. *Nelson*. \$0.50.
- Pompeii and Herculaneum, the Buried Cities of the Campagna. W. H. D. Adams. London. 12mo. *Nelson (New York)*. 3s.
- Prices, Spons' Engineers' and Contractors' illustrated Book of—of Machines, Tools, Ironwork, and Contractor's Material. London. 8vo. *Spons (New York)*. \$3.00.
- Punctuation, a brief Treatise on—containing the more important Rules and Exposition of Principles upon which they depend. Joseph A. Turner. Philadelphia. 16mo. *Lippincott*. \$0.75.
- Railroad, narrow Gauge Mountain—from Hostoken to Marksdorf and Pontzen. Vienna. (German.) 8vo, illus.
- Railroads, Annual Report of the State Engineer and Surveyor on the Railroads of the State of New York, for Year ending Sept. 30, 1874. Albany. 8vo, illus.
- , narrow Gauge— a paper by J. K. Hornish, New York. 16mo, *N. Y. Cheap Trans. Association*.
- Railways, Danver's Report on—in India. (Parliamentary.) London. 8vo. 1s.
- , Return of Accidents for April, May, June, 1875 (Parliamentary.) London. 8vo. 10d.
- , Signal arrangements and Systems of Working. (Parliamentary.) London. 8vo. 8d.
- Scientific Instruction. Vol. 3. Evidence, Analysis of Evidence, and General Index. (Parliamentary.) London. 8vo. 1s. 5d.
- Ships, the Load Line for—and where are its Difficulties; also Quality of Material, Form of Construction, Abilities of Commander, Case of Loss, Grain, Cargoes, Collisions, &c.; to which is added the Unseaworthy Ships Act, 1875. Dissertations by a 30 years' Student. London. 8vo. *Simpkin*. 1s. 6d.
- Smithsonian Institution, annual Report of the Board of Regents of—; showing the Operations, Expenditures, and Conditions of the Institution for 1874. Washington. 8vo.
- Statics, Graphical—new Method of— A. J. Du Bois. (Reprinted from *Van Nostrand's Engineering Magazine*.) New York. 8vo, illus. *Van Nostrand*. \$2.00.
- Stationery, Dictionary of—and Compendium of useful Information for the Office, Country House, and Library. London. 8vo. *Wyman*. 1s.
- Steel, the Manufacture of—, William Hackney; Bessemer Steel Rails. Josiah T. Smith. Minutes of Proceedings, Institution of Civil Engineers. London. 8vo, illus.



- Steel, Use of—for constructive Purposes. Method of working, applying and testing Plates and Bars. J. Barba. Trans. from the French, with a Preface by Alex. L. Holley. New York. 12mo. illus. *Van Nostrand*. \$1.50.
- Stereotomy. Problems in Stone-cutting. S. Edward Warren. New York. 8vo. illus. *Wiley*. 2 50.
- Taxidermanist's Manual; or, the Art of Collecting, preparing, and preserving Objects of natural History, designed for the Use of Travellers, Conservators of Museums, and private Collectors. Thomas Brown. 26th ed. New York. 16mo. *Putnam*. \$1.25.
- Timber and Timber Trees. Thomas Laslett. London. 8vo. illus. *MacMillan*. (New York.) \$3.50.
- Timber Importer's, Timber Merchant's, and Builder's Standard Guide. Richard E. Grandy. 2d ed. rev. (Weale's series.) London. 12mo. *Lockwood*. 3s.
- Trees and Shrubs growing Naturally in the Forests of Massachusetts, a Report originally published agreeably to an Order of the Legislature, by the Commissioners of the zoological and botanical Survey of the State. George B. Emerson. 2 vols. Boston. 8vo. illus. *Little, Brown & Co.* \$12.00. (Colored Plates. \$20.00.)
- Vision: its optical Defects, and the Adaptation of Spectacles. Illus. and with Selections from the Text-Types of Jaeger and Snellen. C. S. Fennner. Philadelphia. 8vo. illus. *Lindsey & Blakeson*. \$3.50.
- Water Supply, the system of constant and intermittent — and the Prevention of Waste, with special Reference to the Restoration of constant Service in Liverpool. George F. Deacon. Minutes of Proceedings, Institution of Civil Engineers. London. 8vo. illus.
- , Report on — for City of Philadelphia made by the Commission of Engineers appointed by the Mayor. Philadelphia. 8vo. illus.
- Weights, Measures and Money of all Nations, compiled by F. W. Clarke. New York. 12mo. *Appleton*. \$1.50.
- Year Book of Facts in Science and the Arts, 1876. Ed. by Charles W. Vincent. London. 8vo. *Ward, Lock & Taylor*. 2s. (Announcement.)

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ADDITIONS TO

LIBRARY AND MUSEUM.

NOTE.—Members and others are asked to contribute regularly to the library of the Society, copies of government, municipal, railway, canal and other reports, specifications, profiles, maps, photographs and like matter, making up the record of engineering operations for the past or present, and to inform the Secretary where such may be had. Duplicate copies are desired, for transmission to foreign societies in return for works collected and sent to this library by them; also for exchange with members and others who wish complete sets referring to particular subjects. In order to gather material now considered of but little value, but of great future importance in the history of the public works of this country and a comparison of their economical results, donations are solicited of old reports or pamphlets, which in any way refer to their construction or operation.

DONATIONS ARE ACKNOWLEDGED AS FOLLOWS:

- From American Iron and Steel Association—Philadelphia, Pa.: Statistical Report of the Secretary, containing detailed Statistics to January, 1875. Philadelphia
- From Boston Public Library: Bulletin No. 35. October, 1875.
- From F. Collingwood, New York: Specifications for cut Stone of Granite and Limestone for N. Y. Anchorage East River Bridge. (2 copies.)
- From the Editors and Publishers New York: The American Cyclopædia. Vol. XIII. Palestine—Printing. 1875.
- From David M. Greene, Albany, N. Y.: Annual Report of the New York State Engineer and Surveyor on the Canals and Railroads—for year ending Sept. 30, 1874. Albany. 1875. 2 vols.
- From J. E. Hilgard, Washington, D. C.: General Index of professional and scientific Papers in U. S. Coast Survey Reports from 1851 to 1870. (2 copies.)
- Report of the Superintendent of the Coast Survey for 1850-51. Washington. 3 vols.
- From Gen. A. A. Humphreys, Chief of Engineers, U. S. A.: Preliminary Report of Explorations in Nebraska and Dakota in 1855, '5 and '57, by Gen. G. K. Warren—Reprint. Washington. 1875.
- Report of Expedition up the Yellowstone River in 1875, by Col. J. W. Forsyth and Col. F. D. Grant. Washington. 1875.
- Sundry General Orders from the War Department, U. S. A.
- From the Institution of Civil Engineers, London: Excerpts from Minutes of Proceedings, Session 1874-5, Vol. XLII, as follows: The Manufacture of Steel by William Hackney, and Bessemer steel Rails by Josiah T. Smith.
- The systems of constant and intermittent Water Supply, and the Prevention of Waste, with special Reference to the Restoration of constant Service, in Liverpool, by George F. Deacon.
- From the Institution of Engineers and Shipbuilders in Scotland. Glasgow: Transactions Vol. XVIII. Eighth Session. 1874-5. Glasgow.

From the Institution of Mechanical Engineers, Birmingham:  
Proceedings June and July, 1875. Nos. 3 and 4. Birmingham.

From Capt. W. A. Jefferds, Chief Bureau of Ordnance, U. S. N.:  
Objects and Resources of the Naval Experimental Battery at Annapolis, Md. Washington. 1875.

From Mansfield Merriman, New Haven, Conn.:  
Yale College Catalogue. 1874-5.

From Ernest Pontzen, Vienna:  
Narrow Gauge Mountain Railroad from Bostoken to Marksdorf, Vienna. 1875. (German.)

From Charles B. Richards, Hartford, Conn.:  
Account of Experiments made comparing Indications of two Cassella's Air Meters. Philadelphia. 1875.

From W. Milnor Roberts, New York:  
Report on the Water Supply for the City of Philadelphia—made by the Commission of Engineers. Philadelphia. 1875. (copies for distribution.)

From the Smithsonian Institution, Washington:  
Annual Reports for 1872, '73 and '74. Washington.

From F. B. Thurber, New York:  
Narrow Gauge Railroads, a paper by J. K. Hornish, read at Meeting of N. Y. Cheap Transportation Association.

From F. Rinecker, Liestal, Switzerland:  
Estimates of Cost of Constructing Section XIII of Swiss Central R. R. Conditions to be complied with, and Profiles of the Work. 18 numbers.

From John Wiley & Sons, New York:  
Catalogue of Scientific Works, for sale by John Wiley & Sons, New York. (Copies for distribution.)  
Hand-Book for Charcoal Burners. G. Svedelius. Trans. from the Swedish by R. B. Anderson. 1875.  
Problems in Stone Cutting. S. Edwards, Warren. 1875.  
Drawing Board, T square, &c., to accompany same.

From D. J. Whittemore, Milwaukee, Wis.:  
Quality of Cement Stone discovered near Milwaukee, and Results of Enquiry into its Strength-Value. 1875. (Copies for distribution.)

From Miscellaneous Sources:  
Reports of J. J. Williams, Chief Engineer on location of the Tehuantepec Railway and Carriage Road, and a Ship Canal across the Isthmus of Tehuantepec. 1870.  
Specifications and Drawings of Patents issued from the U. S. Patent Office for May and June, 1875. Washington. 2 volumes.  
State Canals. Prospectus of the New York Steam Cable Towing Company. Albany, 1872.  
Water Supply—Consumption and Waste. New York. 1875.

## ANNOUNCEMENTS.

**MEETINGS:** The next *stated* meeting of the Board of Direction will be held Wednesday, December 1st, at 3 o'clock p.m., for the transaction of regular business.

The next *regular* meeting of the Society will be held Wednesday, December 1st, at 8 o'clock p.m., when a report from the Board of Direction upon amendments to By-Laws referred at the Annual Meeting is expected; a paper on the "Efficiency of Steam Vacuum Pumps," by J. Foster Flagg, of Meadville, Pa., and one on the "Verrugas Bridge and the Method of its Erection," by L. Lefferts Buck, of Chimbote, Peru, will be presented, and other matters considered. The formal session will close at 9 o'clock, after which an hour will be given to conversation and social enjoyment.

The next *stated* meeting of the Society will be held Wednesday, December 16th, at 8 o'clock p.m., for social intercourse and professional improvement.

PAPERS HAVE BEEN RECEIVED for presentation to the Society, since the list in Annual Report of the Board of Direction was completed, as follows:—

Description and Results of hydraulic Experiments with large apertures, at Holyoke, Massachusetts, in 1874, for which Norman Medal 1875 was awarded:

Theodore G. Ellis.	November 3.
Efficiency of Steam Vacuum Pumps.	
J. Foster Flagg.	November 3.
A Note on the Resistance of Materials.	
Robert H. Thurston.	November 3.
Verrugas Bridge and the Method of its Erection.	L. Lefferts Buck, November 10.

THE ROOMS OF THE SOCIETY are on the southeast corner of Broadway and Twenty-third street, nearly opposite Fifth Avenue Hotel, and overlooking Madison square; entrance 4 East Twenty third street. Until further notice, they will be open from 9 o'clock a.m. to 9 o'clock p.m., excepting Saturdays and holidays. All the meetings of the Society are henceforth to be held at 8 o'clock p.m.

Members—particularly those from out of town—are invited to make these rooms their headquarters. Appointments with other parties may be kept here; and for such, and similar personal matters, a private room can now be had.

## LIST OF MEMBERS.

## ADDITIONS.

GARDNER, G. CLINTON.....	Gen. Supt. Penn. R. R., Altoona, Pa.	November 10, 1875.
KENNEDY, JOHN.....	Eng. Harbor Commission, Montreal, Can. ( <i>Reprint.</i> )	September 13, "
LOTZ, WILLIAM.....	Mech. and Con. Engineer, Chicago, Ill.	October 27, "
MICHLER, AMBROSE K. [J.]....	U.S. Ass't Engineer, Portsmouth, Va.	" 20, "
RADENHURST, WILLIAM N. [J.]..	Ass't Engineer Dep't. of Docks, 117 Duane st., New York.	" 21, "
SEWALL, JOSEPH S.....	St. Paul, Min.	" 28, "

## CHANGES AND CORRECTIONS.

BARNES, PHINEAS [J.].....	Care A. L. Holley, 51 Broadway, New York.
BOGART, JOHN.....	Superintending Engineer, Dept. Public Parks, Union Square, (East) New York,
BRIGGS, ROBERT.....	Editor Journal of the Franklin Institute, Philadelphia, Pa.
CRAVEN, ALFRED W.....	Westminster Hotel, New York.
CROES, J. JAMES R.....	(Civil and Topographical Engineer, Dept. Public Parks) Yonkers, N. York.
DU BOIS, A. J. [J.].....	Prof. Civil and Mech. Engineering Lehigh University, Bethlehem, Pa.
FINK, ALBERT.....	Gen. Commissioner, Southern R'y & Steamship Association, Atlanta, Ga.
GRAHAM, CHARLES K.....	237 Broadway, New York.
HAMILTON, SCHUYLER.....	363 West 28th Street, New York.
HARDING, GEORGE E.....	111 Broadway, New York.
HOLLEY, ALEXANDER L.....	56 Broadway, New York.
KNIGHT, WILLIAM B. [J.]....	Eng. and Ass't Sup't, L. E. E. & S. R'y, Evansville, Ind.
READ, ROBERT L.....	120 Main st., Cincinnati, O.
SCHOTT, C. RIDGELY.....	(Div. Engineer, Dept. Public Parks) 134 East 31st st., New York.
SWAN, CHARLES H.....	Ass't Engineer, Providence Water Works, Providence, R. I.
VAN WINKLE, EDGAR B.....	(Engineer and Surveyor, Street Openings and Improvements, Dept. Public Parks) 111 Broadway, New York.

## RESIGNED.

DODGE, JOSEPH T.....	Madison, Wis.	November 3, 1875.
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# AMERICAN SOCIETY OF CIVIL ENGINEERS.

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## PROCEEDINGS.

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### MINUTES OF MEETINGS.

(Abstract of such as may be of general interest to members.)

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#### OF THE SOCIETY.

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DECEMBER 1ST, 1875.—A regular meeting was held at 8 o'clock P. M.

The President with brief remarks, formally presented the Norman Medal to the successful competitor, Theodore G. Ellis, for his paper giving "Description and Results of hydraulic Experiments with large Apertures," who briefly responded.

The Secretary reported that after consideration of the amendments to the By-Laws, proposed at the Annual Meeting, the Board of Direction recommended to the Society for adoption the following :

Addition to SECTION 1. A Convention of the Society for professional discussion and social intercourse shall be held annually at such place as the Society may determine, and be presided over by a Chairman selected from among Members not officers of the Society. During the Convention a regular meeting of the Society to be presided over by the officers of the Society, shall be held for the transaction of business.

The officers of the Society shall give a reception at the Society's rooms, on the evening of the second Thursday of each month between October and April, for the purpose of informal professional conversation and social intercourse. Regulations concerning refreshments and the invitation of guests shall be made by a committee appointed for the purpose.

Addition to SECTION 16. When, however, the Library Committee does not feel authorized to publish a paper, they may provide an abstract thereof, which, when approved by the author, may be published instead of the original paper.

SECTION ... Special committees to report upon engineering subjects shall be authorized only by a majority of the votes cast by the Society, and in the following manner: Any resolution proposing such a committee shall be referred to the Board of Direction, which shall examine the same and report to the Society. Letter ballots shall be issued embodying a concise statement of arguments for and against the appointment of such

committee ; or, if the Board fails to report within one month, the letter ballot shall be issued without comment. Or, the Society may vote by ballot at the Annual Meeting or in Annual Convention upon such resolution, within one month after it has been submitted to the Board of Direction.

SECTION ... Upon application to the Society for professional service, the President and Board of Direction shall in each case take such action as they may deem best. If they appoint members for the service, the President shall make the nominations, subject to revision and addition by the Board.

SECTION ... The President of the Society shall have the general supervision of the business and correspondence of the Society ; he shall be an honorary member of all committees, but shall have no vote on such.

SECTION ... Annually, on November 1st, all members shall be classed as Resident or Non-Resident, and the Treasurer shall consider those as Resident who do not on notification certify to the Secretary before that day, their residence otherwise.

The recommendation was adopted, and action upon the proposed amendments made, under Section 19, the order of business at the next regular meeting.

Appointment of the following committees was announced : under resolutions adopted April 7th, on "Nomenclature and Classification of Masonry," J. James R. Croes, William E. Merrill and Edgar B. Van Winkle, and on "Gauging of Streams," Theodore G. Ellis, J. Herbert Shedd and David M. Greene ; under resolution adopted November 3d, on "American Engineering at the Centennial Exposition," Theodore G. Ellis, J. James R. Croes, Robert Briggs, Octave Chanute, Alexander L. Holley, William Sooy Smith and William P. Shinn ; and of members of committee on "Eighth Annual Convention," residing in Philadelphia, Thomas C. Clarke, Frederick Graff and Robert Briggs.

A paper on the "Efficiency of Steam Vacuum Pumps," by J. Foster Flagg, C. E., of Meadville, Pa., and one on the "Verrugas Viaduct and Method of its Erection," by L. Lefferts Back, C. E., of Chimbote, Peru, were read and discussed.

The formal session ended at 9 o'clock P. M., after which an hour was given to conversation.

DECEMBER 15th, 1875.—A stated meeting was held at 8 o'clock P. M. as the "first social and conversational meeting of the Society," or officers' reception.

Prof. Robert H. Thurston gave a colloquial lecture on "Professional Intercommunication," which was followed by an informal discussion on this and other subjects.

Refreshments were served at 9½ o'clock, after which an hour was spent in conversation.

## OF THE BOARD OF DIRECTION.

DECEMBER 1st, 1875.—A stated meeting was held at 3 o'clock p. m.

Proposals for admission to the Society were considered ; amendments to the By-Laws referred to the Board at the Annual Meeting were taken up, revised and their adoption by the Society recommended ; special committees of the Board as follows :—on “A revised Constitution,” on “Change of Name” and “Securing National Recognition of the Society,” on “Proposals for Membership,” and on “Rooms”—were continued ; it was determined that the officers should give a reception with refreshments on the evening of December 15th, and Messrs. Holley, Bogart and Collingwood were appointed a committee of arrangements ; also, the treasurer's report for the past month was received, appropriations for current expenditures made, and other routine business done.

## MEMOIRS OF

## MEMBERS WHO DIED IN 1874-5.

APPENDED TO THE

## ANNUAL REPORT OF THE BOARD OF DIRECTION.

EDDY D. MASON was born near Rochester, N. Y. ; became Member of the Society, July 19th, and Fellow December 28th, 1872. He received a fair common school education, and began engineering practice in 1852, as draftsman in the Rochester, Lockport & Niagara R. R. (now a part of the New York Central R. R.) under Mr. Warren Colburn, chief engineer. He was entrusted with the detailed mapping of the line, also the preparation of designs for the passenger stations at Rochester and other points. At the completion of this work he followed Mr. Colburn, then chief-engineer of the Toledo & Wabash R. R., and took charge of the mapping department ; he also designed the more important wood and masonry bridges on that line, and occasionally was detailed for field work ; he was stationed at Lafayette, until in 1855, when he was transferred to the principal office of the company in Toledo.

After the completion of this road he was elected city engineer of Toledo, an office which he held for several years. He also engaged in practice as an Engineer, and to some extent, as an architect.

In 1861 he was commissioned Second Lieutenant, 67th Regiment, Ohio Volunteers, and soon was made a Captain ; in March, 1862, he was detailed for duty as engineer on the staff of Gen. Shields, and in June was appointed Assistant Adjutant-General under Gen. Nathan Kimball, with whom he served during the war in campaigns through most of the Southern States, and finally in Texas, where, in 1866, under Gen. Wright, his military career ended ; he took part in many battles, and was pro-



moted to a coloneley for gallantry in the discharge of his duty on the field.

In 1867, Col. Mason was engaged as draftsman on the staff of the Quincy Bridge; Mr. Thomas C. Clarke, chief-engineer. His ability soon led to an appointment as principal assistant engineer, a position which he acceptably filled till that work was nearly finished. In 1868 he re-entered the service of the Toledo, Wabash & Western R. R. as resident-engineer, with headquarters at Toledo, Ohio, which position he held until 1870, when he was placed in charge as chief-engineer of the construction of the bridge over the Mississippi river, at Hannibal, Mo. The work was driven with great energy, and notwithstanding the difficulties met with, was completed in less than a year. Immediately thereafter he was appointed chief-engineer of the bridge over the Missouri river, at St. Joseph, Mo. This work comprehended not only the construction of the bridge, but also the protection of the river banks and the defining and perpetuation of the channel of the river. The fierce current—the great freshets—the soft alluvial banks—the treacherous bottom—all combined to render the entire work one of great doubt and difficulty; but the patient and watchful skill displayed by the engineer in meeting and overcoming obstacles, achieved a final success, the repute of which is well known to the profession.

He remained in the service of the St. Joseph Bridge Co. until the spring of 1874. The summer was spent in seeking rest and health, but under an insidious and persistent affection of the larynx and lungs, he failed gradually until the end came December 19th, 1874. He died peacefully in his home at Toledo, at the age of 42, leaving a wife and daughter.

Col. Mason was attractive in person and courteous in manner; he was a man of great energy, discrimination and perseverance, of quick apprehension and strong executive ability. In his early death, was lost a valued friend, a capable and a promising engineer.

WILLIAM LEE DEARBORN, died March 15th, 1875, after a protracted and painful illness. He was born on June 12th, 1812, at Salem, Mass. and was the son of Alexander Scammel Dearborn, a gentleman distinguished for his public services and literary labors, and the grandson of Henry Dearborn, a distinguished officer of the revolutionary army, who served at Bunker Hill, Quebec, Saratoga, Monmouth and elsewhere, and was a Major-General in the war of 1812.

Mr. Dearborn was educated in the classical school of Brookline, Mass., but early entered on the study and practice of the profession of civil engineering. His first service was on the Boston & Providence R. R., under his relative Gen. William Raymond Lee; subsequently he was employed on the fortifications in Portland Harbor under Col. Sylvanus Thayer; then as chief-engineer of the State of Maine, in making a survey for a railroad from Portland to Lake Champlain. In

1840 he was an assistant to Col. William Graham of the U. S. Topographical Engineers on the survey and location of the Northeastern boundary of the United States; afterwards he was engaged on the survey and location of the Worcester & Nashua R. R., and on the Grand Junction R. R., in and around Boston; also on the location of the docks and warehouses at its terminus in East Boston. He was next employed in 1851, on the construction of a breakwater from the mainland to Richmond Island, in Maine, and on the construction of the beacon on Point Allerton in Boston Harbor, under Col. Thayer. He also made a plan for a light-house on Minot's Ledge, which received the commendations of Col. Thayer. Subsequently he served for several years with Col. Ogden of the U. S. Engineers, under the Light-House Board. He was at various other times employed on professional work. In 1868, he came to New York, at the request of the chief-engineer of the Croton Aqueduct Department, and served in that department, first as resident-engineer on the enlargement of the Croton Aqueduct across High Bridge, and on the High Service Reservoir and pumping works for the supply of the upper part of Manhattan Island. At the commencement of the Fourth Avenue Improvement (making a depressed road from 42d street to Harlem River), in the city of New York, in 1872, Mr. Dearborn was appointed principal assistant engineer of that work, which position he held till his death. He became a Member of the Society January 29th, 1868.

In the latter years of Mr. Dearborn's life, he was a great sufferer from incurable disease, which, while it checked his physical force, never impaired his mental activity.

JAMES LAURIE, first Member and President of the Society, admitted November 9th, 1852, died March 15, 1875.\*

ISAAC D. COLMAN was born in Nassau, Rensselaer Co., N. Y., June 29th, 1818. His father, a carpenter of limited means, was unable to do much for the education of his four children. Isaac, the eldest, early showed a disposition to study, and after receiving all the instruction the district school afforded, prepared himself, with the assistance of Rev. Mr. Wilcox, for practice as a surveyor. At the age of twenty he commenced by surveying farms, etc., and was soon after largely employed by the Van Rensselaer family, who claimed most of the land in his native county.

In 1846 Mr. Colman removed to Oneida Co., N. Y., and from 1847 to 1851 assisted Daniel C. Jennie, C. E., in building the Black river canal. In 1851 he aided in surveying the lakes in the John Brown tract. In 1853 became resident-engineer of the Rome, Clayton & Ogdensburg R. R., and resided at Ogdensburg, and in 1855, in company with Messrs. Egbert N. Fairchild and Stephen C. Walker, commenced laying out and building railroads in Canada.

In 1858, he removed to New York, and with Messrs. Fairchild, Walker and H. J. Brown, began the construction of the large reservoir in Central

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\* Memoir of Mr. Laurie will be published in a subsequent number of Proceedings.

Park, for the Croton Aqueduct Department. Upon completion of this work, he was appointed chief-engineer of the Hudson River & Harlem Canal Co., and was engaged for two or three years in the surveys and plans for the construction of a canal connecting the Hudson and Harlem rivers with Long Island Sound. The later years of his life were spent as chief-engineer for the Long Island Bridge Co. and making surveys, calculations and estimates and plans, for a bridge across the East River and Blackwell's Island to connect New York with Long Island.

Mr. Colman had an attack of paralysis, March 12th, 1875, and died April 7th following, leaving a wife and three children. He was a member of the Society from February 27th, 1869.

A genial gentleman and a warm and true friend, he was always ready to assist all, especially the young engineer, with his kind practical aid and advice. His extended experience, close observation and decision of character, made him an entertaining and instructive companion; and while the work he has done will be a monument to his sterling worth, pleasant memories of him will always be cherished by his numerous friends.

THOMAS WILLIS PRATT was born in Boston July 4th, 1812. His father was Caleb Pratt, in his day a well-known architect in Boston, who left many monuments of his skill in that city, among them Trinity Church on Summer street, St. Paul's Church on Tremont street, and the spire of the Park Street Church.

It would seem that Caleb Pratt early determined to give his son as good a technological education as the country then afforded. After having passed through the public schools of Boston, he attended an academy at Troy, N. Y., presumably the Rensselaer School, now the Rensselaer Polytechnic Institute, though he does not appear to have regularly graduated there. He had previously aided his father in the duties of an architect and builder, and when only twelve years old made all the working-plans for a dwelling-house, the summer mansion of the late Frederick Tudor at Nahant. At the Troy school he is said to have exhibited particular skill and aptness for the natural sciences, chemistry in particular, and to have received a flattering offer to remain permanently connected with the institution as a teacher. But declining this, he began the practice of civil engineering as aid to the U. S. Government engineers in the construction of the dry docks at the navy yards in Charleston and at Norfolk, Va.

Returning to his New England home from Norfolk, without any definite plans for the future, Mr. Pratt found in the railroad enterprises of the day, then just developing, an inviting field for his engineering skill and inventive talent. He was first employed upon the Boston & Lowell R. R. and then on the Boston & Worcester, under the late Mr. Chesbrough, who had charge of the western division. In 1835 he was division-engineer in the construction of the Norwich & Worcester R. R. under the late Mr. James Laurie, and subsequently superintendent of

that road. He was engineer of the Providence & Worcester R. R. in 1845-47, and afterwards acted as superintendent of that road also. Still later he became superintendent of the Hartford & New Haven R. R.

Mr. Pratt was next chief-engineer of the Middletown Branch R. R., also of the "Air Line" in Connecticut, also of the Gloucester Branch of the Eastern R. R. in Mass. He then became chief-engineer and superintendent of what was then called the New York & Boston, now part of the New York & New England R. R.; and lastly, in 1871-'2, of the Conway & Great Falls Branch of the Eastern R. R. running into the White Mountains. In 1865 he commenced the construction of the Newburyport Bridge for the Eastern R. R.

Mr. Pratt did much other engineering work during all these forty years or more, and was extensively consulted by railroadmen and others on many of the professional questions of the day. He was extremely reticent, so much so, that with the exception of a few remarks in Volume I of Transactions of the Society (pages 346-8), it is not known that any of his technical writings are in print. His *nom de plume* when he wrote on questions of the day in newspapers was "Bruno," and in that guise he may be found or remembered by some citizens of Boston.

Mr. Pratt was best known to the general public as the inventor of the system of bridges called the "Pratt Truss," for which a patent was awarded him April 4th, 1844, and extended March 29th, 1858.\* The originator of what is now called the *panel* system of bridges, it is well known, was Col. Stephen H. Long, of the U. S. Topographical Engineers, who patented wooden panel trusses in 1830 and 1836. He devised both what was then called the *braced* and the *suspension* system of panel bridges; that is, the system having diagonal struts and vertical ties and that having diagonal ties and vertical posts; but rigidly adhering to the idea that in a wooden bridge all parts must be of wood, his bridges were defective in the construction of their tension members and it having many pieces, wedges, &c., which served to maintain tension. These were continually getting loose and necessitating frequent adjustments. It was to do away with these defects that William Howe, of Warren, Mass., boldly cut loose from this adherence to wood as the only building material, and in 1840 introduced vertical rods combined with what he termed "wedge-blocks between the feet of the braces," thus making the well-known Howe truss.

The great object with bridge builders in those days seems to have been to produce camber in a primarily horizontal truss, and accordingly Howe, and after him Pratt in 1844 describe their inventions as means of producing any required camber. The examiner of patents when the patent referred to was granted (Report for 1844, page 500) seems to have scarcely appreciated the distinctive features of the Pratt truss. He calls it a new way of producing camber by means of two rods in each panel.

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\* For the claims of this patent see Journal of the Franklin Institute for 1844, page 410.

where former inventors had only one. Mr. Pratt's invention, it will be noticed, does away with the Howe "wedge-block," and makes besides a lighter bridge than the Howe truss. As such it was soon appreciated and was extensively used in the framing of western river steam-boats, for example; this reason may have also induced the late John A. Roebling, to use the Pratt truss as the stiffening girders for the Niagara R. R. Suspension Bridge. When made with iron posts and iron top and bottom chords, it may be said that the Pratt truss is to-day the most popular type of American bridge truss, though of course the advance of knowledge soon taught Mr. Pratt and others to modify those notions of the powers of the camber and of the need of counters, except for short distances each side of the centre of the bridge. Engineers have also learned to correctly proportion the several parts and other important matters of detail, the introduction of all of which have well nigh rendered the original Pratt truss unrecognizable in the very perfect iron bridges of to-day. Mr. Pratt's early appreciation (1846) of the various forms of web may be gathered from the paper already referred to. In text-books the Pratt truss is given as a *type truss*,\* and thus, with justice, will hand Mr. Pratt's name down to posterity in the long line of the bridge-builders.

The patent of 1844 was taken out in the name of Thomas W. Pratt of Norwich, Conn., and Caleb Pratt of Boston, it is said more on account of the son's desire to please his father, than from any real part the latter had in the invention. In that same year, the Massachusetts Charitable Mechanics' Association awarded a gold medal for their "suspension bridge;" Mr. Pratt derived little or no pecuniary profit from the invention. Nothing daunted, and ingenious as he was, he made other inventions and continued to take out patents on them, almost to the day of his death.

Among these are the following: in 1844, that already mentioned. In 1865 an improvement in steam boilers, in which the flues and tubes were inclined, and the shell cone-shaped; also a safety coal trap. In 1870, a mode of equalizing the pressure of draw-bridges upon the "live ring" under them. In 1871, an improved form of Warren girder, made up of iron channel bars;† and in 1873, a truss bridge which may be described as a wooden Warren girder made of planks, the number of planks in the chords and web, increasing with the increase of strain in the middle and ends respectively; the whole fastened together with tree-nails. For larger spans there were two web systems in each truss of the bridge, and to stiffen this web against compression, the adjoining two bars or sets of bars were sprung apart laterally at their middle and held so by suitable clamps or bolts. Mr. Pratt used this truss extensively on the Great Falls & Conway branch of the Eastern R. R., in 1871, and for a cheap wooden

\* See "Treatise on the Construction of Bridges and Roofs," by Prof. De Volson Wood, for example.

† Mr. Pratt built bridges on this plan in 1871, at Beverly, Mass., and Union-Village, N. H.

truss, it answered "exceedingly well. Ordinarily it could be laid together ready for boring and tree-nailing in an hour, and as rapidly completed. Also, in this year, another improvement in steam boilers, in which the cylindrical shell was inclined. Experiments on these boilers were being carried on by Mr. Pratt at the time of his death. In 1875, an improvement in the shape or construction of vessels, which Mr. Pratt had considered as early as 1868. The lines made by horizontal sections of the fore part of the vessel were to be isosceles triangles, those of the after part, ellipses. Also, in this year, he patented a device for propelling vessels, a species of water ejecting apparatus.

The Eastern R. R. bridge across the Merrimac river, at Newburyport, is one of Mr. Pratt's best works. The foundations were all laid with a diving-bell, operated by a minute reversible engine; the piers and abutments are well built of granite, and start from the solid bed rock, or in some cases from piles sawed off low down. The superstructure, a wooden Pratt truss of 6 or 7 long spans, was built on stagings near the site of the bridge, then span by span lifted off the stagings by the tide, and allowed to settle on the piers. An iron draw-bridge, a Warren girder, completes the structure. Some points connected with the end supports of the draw and the wind-bracing of the fixed spans, deserve special mention, but cannot here be described properly. This work was assigned to Mr. Pratt through the late Mr. James Laurie, his chief in 1835, and was the beginning of Mr. Pratt's later connection with the Eastern R. R., which lasted until his death.

A characteristic of Mr. Pratt, besides his reticence, was his wonderful memory. To write for an assistant, in the field, the formulas required in laying out a switch, for example, or any others he had ever used, together with the proofs for each, was to him an easy matter.

Mr. Pratt, when division engineer on the Norwich & Worcester R. R., married Miss Sarah Bradford, of Plainfield, Conn., and left a son and daughter. He was Member of the Society from November 2d, 1853, until its re-organization, and one of the second Board of Direction; he became a Fellow, November 4th, 1870.

He was one of the pioneers of the American railway and bridge systems, and during his useful life was not less distinguished by modesty than by integrity.

HENRY A. GARDNER, was born in Syringham, Berkshire Co., Mass., April 20th, 1816. His perseverance early laid the foundation for an education, and in 1836, the Great Western R. R. Co. having determined to extend its line from Worcester westward, he was appointed as rodman in the survey, under Mr. Richard P. Morgan. A northerly route through Pittsfield, was decided upon, in the location of which he was advanced to the position of junior assistant. On that work he matured a naturally sound judgment, and gained an experience in locating railroads through a country of great physical obstacles.



In 1839 he was engaged on a survey from Westchester Co. to Albany, aiding in the location of a very important part of the New York & Albany R. R., since incorporated in the Harlem R. R. In 1841, he assisted in exploring the Highlands, to ascertain the practicability of constructing a line along the Hudson river, where the Hudson River R. R. is now located, and in 1842 was engaged in the preliminary surveys of that road. In 1843 he removed to Albany, and was assistant engineer on the Mohawk & Hudson R. R.

In 1845, the Hudson River R. R. Co., having failed to obtain a charter, Mr. Gardner being offered strong inducements by his former chief, Capt. Swift, accepted the position of division engineer on the Illinois & Michigan Canal. In 1847, he was called to assist in the construction of the Hudson River R. R., under Mr. John B. Jervis, chief-engineer, and until 1850 was stationed at Tarrytown, and engaged in work near that point; subsequently he removed to Poughkeepsie, acting first as principal assistant to Mr. William C. Young, and afterwards as chief-engineer of the road. This latter position he retained until 1853, when, at the solicitation of Mr. Oliver H. Lee, he again went to Illinois to superintend the construction of the Chicago, Alton & St. Louis R. R., from Bloomington to Joliet, retaining at the same time the position of consulting engineer to the Hudson River R. R. He continued as chief-engineer and Vice-President of the former until 1857. During the same time he occupied positions on the Peoria & Oquaka R. R., the Joliet Cut-off and other lines.

After spending a few years on his farm, at Dwight, Illinois, he accepted a position, in 1861, on the Hudson River R. R., and about the same time was appointed by Gov. Morgan on a commission to examine the defenses in New York Harbor. In 1862, he became assistant-general superintendent of the Pittsburgh, Fort Wayne & Chicago R. R., under Mr. John B. Jervis, general superintendent, was afterwards chief-engineer, and remained in that position until 1870. While thus occupied, he was also chief-engineer of the Grand Rapids & Indiana R. R., the Massillon & Cleveland R. R., and the Lawrence R. R. When in 1870, the former railroad was leased to the Pennsylvania Co., his services as chief-engineer were immediately required by the Michigan Central R. R. Co., and he occupied this position at his death, July 26th, 1875.

The care and industry with which Mr. Gardner discharged the duties pertaining to every position held by him, together with his strict integrity, gained for him general respect, and the confidence of those investing money in railroads. His accuracy is well exemplified by a statement he made a short time before his death: "That he never had a bill approved by him returned for correction or even explanation, during his whole professional life."

In 1842, Mr. Gardner married Miss Sarah P. Morgan; they had five sons, who survive him. He was one of the first Members of the Society, having been admitted December 13th, 1852.

Mr. Gardner left an enviable reputation for sterling integrity in the discharge of his professional duties. Social and genial in his private relations, and of a considerate temper, he was indisposed to controversy on small matters, but uncompromising on any question involving a principle or the surrender of interests committed to his charge. In every relation he was an honest, christian gentleman.

EDWARD H. TRACY, late chief-engineer of the Croton Aqueduct and of the Department of Public Works of the city of New York, an able member of the profession of civil engineering, was born in Whitesboro, Oneida Co., N. Y., in 1817.

He received his early education at the Academy, in the city of Utica, and in 1834, then 17 years of age, engaged in that pursuit in life, which he followed with slight interruption to its close. The State was then entering upon the construction of the Chenango Canal, with John B. Jervis as chief-engineer. Under him Mr. Tracy served first as rodman, and remained on the work until its entire completion, thus acquiring a knowledge of the practice and details of his profession, which in after life was invaluable to him. After three years thus spent, he renewed his studies at the Albany Academy, under the direction of Dr. Beck. It was not long before he was again called into active life. The city of New York had begun its most important work—the building of the Croton Aqueduct, John B. Jervis, chief-engineer. In the spring of 1838, then only 21 years old, Mr. Tracy was appointed assistant engineer, and took charge of the division of the Aqueduct between Fordham Manor Church and Manhattanville, which included the High Bridge over the Harlem river. He saw the first spadeful of earth thrown out, and remained until the last stone of the Croton Aqueduct was laid.

When, at the completion of the work, Mr. Jervis resigned, Mr. Tracy was appointed his successor, and as engineer continued in charge of the Aqueduct until 1852. He then resigned and entered into copartnership with Mr. Quintard, in the Morgan Iron Works, taking more especial charge of the manufacturing department; but after an experience of two years, he again returned to the more congenial practice of civil engineering. He was employed to make the surveys and plans for a ship canal to connect the waters of the St. Lawrence and Lake Champlain. He had charge of the improvement of the Des Moines river by slack water navigation. He made for the Chicago & Rock Island, and Mississippi & Missouri R. R. Co's., surveys of the rapids in the Mississippi, gauged the river, and constructed the chart to be used in court, and as an expert, did much towards settling the vexed question of the propriety and right of bridging navigable waters, when it should become necessary to commerce. He afterwards became connected with the Cumberland Coal & Iron Co., and in the several positions of engineer, superintendent and president, aided it, until it became a valuable property and was merged in the Consolidation Coal Co.

During all these years, Mr. Tracy continued a citizen of New York, and claimed it as his home. In 1870, he was appointed chief-engineer of the Croton Aqueduct, and held this office until his death. Twenty years' experience in connection with the Aqueduct had well qualified him for the work, which he knew from its beginning.

Mr. Tracy was a well educated and accomplished engineer; a genial companion and friend, and a thoroughly honest man. He became Member of the Society June 13th, 1868, and died August 28th, 1875, much lamented.

IRA SPAULDING, Member of the Society from August 2d, 1870, was born in Vernon, Oneida Co., N. Y., November 12th, 1818, and died October 2d, 1875.

He commenced the practice of his profession as civil engineer on the Syracuse & Utica R.R., in 1839. On the completion of this road he was engaged on the surveys of the Syracuse & Oswego R.R. In the spring of 1840 he was appointed resident engineer on the Susquehanna division of the New York & Erie R.R., and subsequently principal assistant to Charles B. Stuart, chief-engineer of that division. In 1843 he was appointed chief-engineer of the Bear Mountain R.R. in Pennsylvania.

In the spring of 1847 Mr. Spaulding was appointed principal assistant engineer in charge of the surveys of the western half of the Great Western R'y of Canada. While this work was suspended he located the Rochester, Lockport & Niagara Falls R.R., now a part of the New York Central R.R., and on the resumption of work of the Great Western R'y, in 1850, he was appointed associate engineer.

Within a few weeks after retiring from this position, Mr. Spaulding was appointed chief-engineer of two other railroads in Canada, the Erie & Ontario and the Coburg & Peterborough. After the construction of these roads he retired for a while from the active practice of his profession, and settled down at what he intended to be his permanent home near Niagara Falls, on the Canada side. His health had become much impaired in consequence of an accident which occurred to him on a winter trip from Montreal to Quebec. As a means of restoration to health and partially for a pleasure trip, he spent a season on the northeast coast of Labrador, and in the interior of British America, added something to his knowledge of geology and natural history.

On the breaking out of the late war, although Mr. Spaulding had intended to make his permanent home in Canada, and had large landed interests there, he could not forget that he was a citizen of the United States. Immediately after the battle of Bull Run he returned to his native State, to assist Gen. Chas. B. Stuart in organizing an engineer regiment, and when it (the 50th New York Volunteer Engineers) was mustered into service in August, 1861, though still suffering much from ill health, Mr. Spaulding went with it as Captain. This regiment was

assigned to duty with the army of the Potomac, and took part in all active operations, from the day it entered the field until it was disbanded, in all of which, and in the several ranks of Captain, Major, Lieut.-Colonel, Brevet Colonel, and Brevet Brig.-General, he bore a prominent part.\* Gen. Benham, commanding the engineer brigade, was in Washington at the time the army retired to Centreville, but, on receiving reports of the movement, he published to the brigade, general order No. 51, from which the following is an extract: "This report of the unwearied efforts of the detachment under Lieut.-Col. Spaulding, in the rapid construction and removal of the several bridges on the Rappahannock and upon the smaller streams this side, and their successful efforts for the preservation of their trains through the six days' march of the army to its new position, merits and receives from the General the highest commendation, not only for Lieut.-Col. Spaulding, whose promptness, efficiency and gallantry have been conspicuous on so many previous occasions, but also for the officers and men of his fine regiment who were with him, and whom he reports to have behaved most admirably during the whole movement." During the siege of Petersburg he was breveted a Colonel for gallant and meritorious services in the field.

During this siege, also, Col. Spaulding had built in his camp that rustic church, since so famous and so much admired, and which the regiment on leaving the camp presented to the trustees of the Old Poplar Grove Church, which had been destroyed by the army near the same site. The signal tower, 150 feet high, near Fort Fisher, was also designed and built under Col. Spaulding's directions.

After Lee's surrender, Col. Spaulding was breveted a Brigadier-General for gallant and meritorious services with the armies operating around Richmond. On the march of the army of the Potomac through Richmond, by Gen. Meade's order, the engineer brigade, Gen. Benham in command, occupied the right of the army, Gen. Spaulding and his command being on the extreme right, the post of honor. "The regiment was ordered to Elmira under command of Gen. Spaulding, and there mustered out of service, with a record of which every member may forever feel justly proud. During his whole term of service, he neither used or possessed personal or political influence to obtain promotion; such promotions as he did receive were given unsought, and as a recognition by his superior officers of valuable service."

After the close of the war, Gen. Spaulding returned to the practice of his profession, and early in 1866 was appointed chief-engineer of the Utica, Chenango & Susquehanna Valley R.R. In May, 1867, he resigned this position to accept the appointment of chief-engineer of the Minnesota division of the Northern Pacific R.R. He reported for service in New York in December of that year, and during the winter and

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\* See Vol. I, American Biography, Art. "Brevet Brigadier-General Spaulding,"

summer following was engaged in Washington for that company. In December, 1868, operations on this being for a time suspended, Gen. Spaulding accepted the appointment of engineer-in-chief of the Costa Rica R.R.

In January, 1870, Gen. Spaulding was again engaged on the Northern Pacific R.R., and soon afterwards was reappointed to his former position as chief-engineer of the Minnesota division. Ground was broken February 15th, 1870, and December 30th, 1871, the rails were laid to Moorhead, on the east bank of the Red River of the North, 250 miles west of Duluth. During the latter part of the year he was engaged on the Northern Pacific, Gen. Spaulding also had charge of the location and construction of the Brainerd branch of the St. Paul & Pacific R. R. In the spring of 1872, having completed the Minnesota division and closed the contracts for construction, he resigned his position as chief-engineer and returned to New York.

In 1872, Gen. Spaulding was struck down with the disease which ended his professional career. He was a courteous, high-toned gentleman, and in every position, and in all his relations—to his family, to his country, to his profession, and to society, he was respected and beloved by all who knew him. As a civil engineer, his skill, energy and thorough knowledge of his profession, together with his unquestioned integrity, gave him high rank, and the numerous works he built are his most enduring monument.

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## ANNOUNCEMENTS.

**MEETINGS:** The next *stated* meeting of the Board of Direction will be held Wednesday, January 5th, at 3 o'clock P. M., for the transaction of regular business.

The next *regular* meeting of the Society will be held Wednesday, January 5th, at 8 o'clock P. M., when ballots for members will be canvassed; the amendment to By-Laws recommended by the Board of Direction, December 1st, acted on; a paper on the "Portage Bridge," by George S. Morison, C. E., of New York, presented, and other matters considered; after the formal session an hour will be given to conversation.

The next *stated* meeting of the Society will be held Wednesday, January 19th, at 8 o'clock P. M., for social intercourse and professional improvement.

PAPERS HAVE BEEN RECEIVED for presentation to the Society since the announcement in December Transactions, as follows:

The Portage Bridge:—George S. Morison, November 27th, 1875.

On Braced Arches:—A. Jay DuBois, November 30th, 1875.

THE CURRENT VOLUMES of "Transactions" and "Proceedings" close with this issue. A "List of Contents" of each will be published with the January number, and henceforth the volumes will begin and end with the calendar year.

AS AN APPENDIX to this number of Transactions, are issued:—

The Metric System of Weights and Measures, a communication to the members of the Society from Messrs. Frederick Brooks, L. Frederick Rice and Clemens Herschel.

Milwaukee Water Works: Reports on the Trial of Duty and Capacity of the Pumping Engines, May, 1875:—by Messrs. William E. Worthen, Thomas J. Whitman and Charles Herman.



# AMERICAN SOCIETY OF CIVIL ENGINEERS.

## PROCEEDINGS.

### MINUTES OF MEETINGS.

(Abstract of such as may be of general interest to members.)

#### OF THE SOCIETY.

JANUARY 5TH, 1876.—A regular meeting was held at 8 o'clock P. M.

The vote on admission to membership was canvassed and the following declared elected:—Corresponding Member: Mr. Ernest Pontzen of Vienna, Austria; Members, Messrs. Charles G. Darrach and Rudolph Hering of Philadelphia, Pa.; Alphonse Fteley of Boston, Mass.; Peter A. Peterson of Toronto, Can.; Clinton B. Sears of Engineer Corps U. S. A. and Henry R. Worthington of New York; and Junior, Henry D. Blunden of New York.

Replies to circulars issued under resolution adopted at the last Annual Meeting, referring to the organization of a Civil Engineers' Insurance League, were also canvassed, and it was announced that 59 Members and Juniors would join the League and 62 would not.

Communications from George E. Gray and William P. Shinn of December 13th, relating to this League, and from the latter, of same date, "concerning Conventions;" and from W. Milnor Roberts of November 22d, proposing a dinner to Sir Charles A. Hartley, with reply, were read.

The President was authorized to add at his discretion to the members (residing in Philadelphia) of the Committee on Eighth Annual Convention.

The Amendments to the By-Laws recommended December 1st by the Board of Direction to the Society for adoption, were considered section by section and action taken thereon:—

Addition to Section I, was amended\* as follows, and reported to the Society for adoption at the next regular meeting:—

Addition to SECTION 1. A Convention of the Society for professional discussion and social intercourse shall be held annually at such place as the Society may determine, and be presided over by a Chairman selected from among Members not officers of the Society. During the Convention a regular meeting of the Society to be presided over by the officers of the Society, *may* be held for the transaction of business.

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\* Changes are in *italics*.



The officers of the Society *may* give a reception at the Society's rooms, on the evening of the second and the fourth Wednesday of each month between October and April, for the purpose of informal professional conversation and social intercourse. Regulations concerning refreshments and the invitation of guests *may* be made by a committee appointed for the purpose, *but shall be without expense to the Society.*

The following sections were corrected and then adopted:—

ADDITION TO SECTION 16. When, however, the Library Committee does not feel authorized to publish a paper, they may provide an abstract thereof, which, when approved by the author, may be published instead of the original paper.

SECTION ... Special committees to report upon engineering subjects shall be authorized only by a majority of the votes cast by the Society, and in the following manner: Any resolution proposing such a committee shall be referred to the Board of Direction, which shall examine the same and report to the Society *a concise statement of the argument for and against the appointment of such committee, which statement shall be printed and issued to this Society with letter ballot*; or, if the Board fails to report within one month, the letter ballot shall be issued without comment; or, the Society may vote by ballot at the Annual Meeting or in Annual Convention upon such resolution, within one month after it has been submitted to the Board of Direction.

SECTION ... The President of the Society shall have the general supervision of the business and correspondence of the Society; he shall be an honorary member of all committees, but shall have no vote on such *committee.*

The next section considered was:—

SECTION ... Upon application to the Society for professional service, the President and Board of Direction shall in each case take such action as they may deem best. If they appoint members for the service, the President shall make the nominations, subject to revision and addition by the Board.

For this, it was proposed to substitute:—

1st. Upon application to the Society for professional service, the President shall in such case recommend members therefor, subject to revision and addition by the Board of Direction;—and

2d. Applications to the Society for professional service shall be referred to the President and Board of Direction for suitable action.

After discussion, this section was made a special order at the business meeting of the Eighth Annual Convention.

The last section was referred back to the Board of Direction for revision; it is as follows:—

SECTION ... Annually, on November 1st, all members shall be classed as Resident or Non-Resident, and the Treasurer shall consider those as Resident who do not on notification certify to the Secretary before that day, their residence otherwise.

## CODE OF RULES FOR THE AWARD OF THE NORMAN MEDAL.

I. Competition for the Norman Medal of the American Society of Civil Engineers shall be restricted to members of the Society.

II. There shall be one gold medal, and only one, struck for each and every fiscal year of the Society, and awarded as hereinafter provided. The dies therefor shall be with the Superintendent of the United States mint at Philadelphia, in trust exclusively for the aforesaid purpose. Such medal shall be of a cost equal to the annual interest received upon \$1 000 of the consolidated stock of the city of New York; certificate No. 179, of additional new Croton Aqueduct stock of the city of New York, authorized by an act of the Legislature of the State of New York, Chap. 230, passed April 15th, 1870, dated November 17th, 1873; now held in trust by the Treasurer of this Society, and so held solely for this purpose; and shall be executed upon his order.

III. The President of the Society, the President of Columbia College, and the Engineer Officer of the United States Army commanding in that capacity in New York city and vicinity, shall be, ex-officio, a Board of Censors, whose duty it shall be to examine all papers entitled to competition under these rules, and award the Norman Medal as a prize of merit, as hereinafter provided.

IV. No papers shall be entitled to competition except such as are of practical engineering interest; it being the expressed intention of the donor to exclude from competition all papers of a purely speculative or theoretical character.

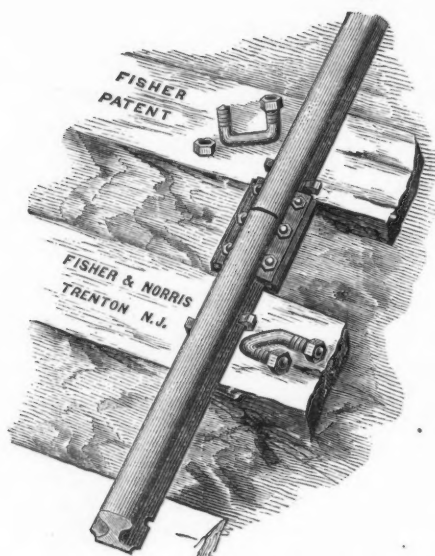
V. Each paper submitted for competition shall be headed with the title, but shall not exhibit the author's name on any part of the manuscript; it shall be accompanied with a sealed envelope, superscribed with the title, and enclosing both the title and the name of the author; the whole to be enclosed in an envelope addressed to "The President of the American Society of Civil Engineers," and conspicuously endorsed "For Norman Medal, year....." and presented at least two months prior to the Annual Meeting; and no paper otherwise presented, or in possession of the Society, shall be admitted to competition, nor except for the fiscal year in which it shall have been presented.

VI. All papers presented in accordance with the foregoing rule shall first be submitted by the President to the Board of Censors, and after their examination, and at the Annual Meeting, the President shall present the successful essay, together with the sealed envelope containing the author's name, accompanied with the certificate of the Board of Censors, to the Society—when the envelope shall be opened, the author's name announced, and the award declared. Such award shall be entered on the Minutes and published in the proceedings of the Annual Meeting. If for any reason, in any year, there shall be no award of this medal, then the amount of the interest of the fund for that year shall be expended by the Board of Direction in the purchase of books; said books to be offered as a premium for the second best competing paper for the medal of the succeeding year.

VII. The Treasurer of this Society shall cause the medal to be prepared and delivered to, or deposited to the order of the successful competitor, within two months after the Annual Meeting at which the same shall have been awarded.

VIII. The Board of Censors may make such regulations, consistent with this Code, as they may deem proper, and shall have power to fill vacancies in said Board.

(II)



## THE "FISHER" Patent Rail Joint,

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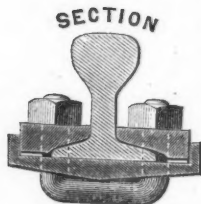
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Of these bolts, usually in pairs in the    form, one, two, three or four are employed as desired. From their large diameter (one inch), and acting

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Joints taken from the track of the Boston & Providence R. R., after *thirteen years'* continuous use, show this wear to have been

$\frac{1}{8}$ th of an inch.

No holes are made in the stem of the rail. The only slotting is for elliptical notches in the edges of the flanges and without perceptible weakening of their strength. Several varieties have been in use on important roads, for from four to thirteen years—either between ties, on one tie, or extending the lower plate over two ties, and in every case have demonstrated that for preservation of rails, smoothness of track, and saving in labor and repairs, the *vertical* system, holding the rail by its broad base instead of under the head, directly by large vertical bolts, is the correct one as opposed to fish bars, which are dependent on horizontal bolts to keep them in place—subject to rapid, unequal wear and cross-strains, and with continual loosening of nuts. All fish bars wear greatest at their middle, and after three or four years' use they will be found so much more worn there than at their ends that a perfect bearing can be no longer obtained by screwing up the nuts, and a rapid destruction of the ends of the rails obtains soon after.

Among the roads which have used these joints in large quantities for a number of years, are the Fitchburg R. R., Boston & Providence R. R., Pennsylvania R. R., Lehigh & Susquehanna R. R., Philadelphia, Wilmington & Baltimore R. R., Cumberland & Pennsylvania R. R., Delaware & Hudson Canal Co., &c.

THE MANUFACTURERS INVITE ORDERS FOR TRIAL LOTS FROM  
ROADS WHICH HAVE NOT YET USED THIS JOINT.

FOR SALE,

# An Unfinished Iron, Twin Screw, Steam Vessel,

HAVING DOUBLE BOTTOM AND WATER-TIGHT COMPARTMENTS.

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Length between Perpendiculars.....	390 feet.
Breadth of Beam.....	45 "
Depth to Main Deck.....	24 1/2 "
Displacement at 22 feet Draught.....	6,000 tons.
Area of Midship Section.....	890 sq. ft.
Number of Transverse Bulkheads.....	7.

## ENGINES.

TWO PAIRS, EACH PAIR DRIVING ONE SCREW.

Diameter of Steam Cylinder.....	72 inches.
Stroke of Piston.....	45 "
Surface Condensers, Area.....	12,560 sq. ft.

## SCREWS.

Diameter.....	18 feet.
Pitch.....	27 "
Number of Blades.....	3.

## BOILERS.

TEN IN NUMBER; ORDINARY HORIZONTAL FIRE, TUBULAR TYPE.

Total Heating Surface.....	28,000 sq. ft.
Grate Surface.....	876 "

This vessel was intended to be completed for the State of New Jersey, as an Iron Clad.

The plans were prepared and the work was carried on under the direction of General GEORGE B. McCLELLAN, U. S. A. All materials, and the workmanship are guaranteed to be of the best possible description.

The funds appropriated for the purpose of completing the vessel not proving sufficient, the Legislature of the State of New Jersey has directed that a sale be made to the highest bidder. The Commission, consisting of

HIS EXCELLENCY GOVERNOR JOEL PARKER, of Trenton,

VICE-CHANCELLOR AMZI DODD, of Newark,

HONORABLE MESSRS. W. W. SHIPPEN and S. B. DOD, of Hoboken, has been appointed to effect such sale.

Bids endorsed "PROPOSALS FOR THE PURCHASE OF IRON STEAMER, OR OF PARTS THEREOF," may be addressed to the Governor of the State of New Jersey, by whom they will be received at Trenton, N. J., until 12 o'clock M., on the

## Second Day of November, 1874.

at which time they will be publicly opened.

Blanks for proposals, and a pamphlet containing a detailed description of the vessel, as nearly completed, except as to armor and armament, may be obtained by addressing either member of the Commission, or the undersigned.

Permission to examine the vessel, and to inspect the premises, may be obtained (by intending purchasers) on application at the Dry Dock, where the ship now lies, or to the Consulting Engineer to the Commission, who will be prepared to exhibit drawings to explain the structure of hull and machinery, and to give any other information respecting the vessel.

**R. H. THURSTON,**

*Consulting Engineer to the Commission,*

Hoboken, New Jersey.

# THE WHARTON

## Patent Safety Railroad Switch.

THE MAIN TRACK ENTIRELY UNBROKEN AND CONTINUOUS.

BOTH RAILS OF THE MAIN TRACK ARE ENTIRELY UNDISTURBED, so that the same is unbroken and solid :—therefore, so far as the main track is concerned, switches are entirely dispensed with.

THIS IS THE ONLY RAILROAD SWITCH THAT ACCOMPLISHES THAT MOST IMPORTANT OBJECT.

By thus providing a perfectly solid and continuous track, the shocks and jars which are the unavoidable result of the two open joints left in ordinary switches are done away with, and there is consequently a great saving in wear and tear of the rolling stock, and of the rails themselves at that point.

Perfect security is given to trains if the switch is by accident left wrong, nor is there any injury done to the switch itself. This protection is so positive that there is no need of targets or other signals to indicate the position of the switches on double-track railroads; while the operating apparatus for switches on single-track railroads is so arranged that the switch will not remain set for the siding if the switchman should forget his duty.

This switch is adopted by the Pennsylvania Railroad Company; Philadelphia, Wilmington and Baltimore Railroad Company; Chesapeake and Ohio Railroad Company; Baltimore and Potomac Railroad Company; Central Pacific Railroad Company; New Haven and Northampton Railroad Company; Bennett's Branch of Alleghany Valley Railroad Company; Connecticut River Railroad Company; United Companies of New Jersey; New Orleans and Great Northern Railroad Company; Northern Central Railroad Company; Wilmington and Weldon Railroad Company, and other leading Railroads.

STEEL RAIL FROGS AND CROSSINGS of all angles and of the most approved patterns, are also manufactured by us.

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